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GRADUATION PROJECT

Title

 **BuyWise**

AI-powered review verification

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Abstract

With the rapid expansion of e-commerce and digital platforms, online reviews have become a key factor in consumer purchasing decisions. However, the growing use of artificial intelligence to generate fake reviews has raised serious concerns about the reliability of review content. These AI-generated reviews often appear highly convincing, making them difficult for users to detect and weakening trust in online platforms.

To address this challenge, this project introduces *BuyWise*, a comprehensive web-based platform designed to detect and reduce the spread of computer-generated fake reviews. The platform allows users and companies to share genuine product experiences, supported by an AI-powered system that validates reviews using natural language processing and machine learning techniques.

BuyWise was developed using the Scrum methodology across three iterative sprints, which include key features such as user and company profiles, product management tools, multilingual support (Arabic and English), structured review modules, and interactive comment threads. In addition, to promote authentic user participation, *BuyWise* incorporates a gamified reward system that includes points, badge recognition, and redeemable company vouchers.

By combining real-time AI detection with an engaging and transparent review environment, *BuyWise* helps users access trustworthy opinions while minimizing the influence of deceptive, Computer-generated content. This approach promotes fairness, reinforces user trust, and supports informed decision-making in the digital marketplace.

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List of Abbreviations

Abbreviation	Full Form
AI	Artificial Intelligence
ML	Machine Learning
NLP	Natural Language Processing
RoBERTa	Robustly Optimized BERT Pretraining Approach
SVM	Support Vector Machine
BERT	Bidirectional Encoder Representations from Transformers
BiLSTM	Bidirectional Long Short-Term Memory
AUC	Area Under the Curve
F1	F1 Score (Harmonic Mean of Precision and Recall)
HTML	HyperText Markup Language
CSS	Cascading Style Sheets
JS	JavaScript
PHP	Hypertext Preprocessor
XAMPP	Cross-Platform Apache MariaDB PHP Perl
API	Application Programming Interface
SQL	Structured Query Language
DB	Database
UI	User Interface
UX	User Experience

Chapter 1 : Introduction

1.1 Introduction

In today's digital economy, online product reviews play a critical role in shaping consumer behavior and purchase decisions. Nearly 60% of shoppers rely on these reviews to assess product quality and reliability before making a purchase [1]. As e-commerce continues to grow, so does the importance of honest and trustworthy user-generated feedback. However, the increasing presence of fake and computer-generated reviews threatens the integrity of this system. To address this challenge, *BuyWise* was developed as an AI-powered review platform that detects fake reviews, rewards authentic contributions, and supports users in both Arabic and English. By combining advanced review verification with a gamified reward system, *BuyWise* aims to restore trust in online reviews while creating an engaging and transparent user experience.

1.2 Problem statement

Despite the importance of online reviews in guiding consumer decisions, the growing prevalence of fake and computer-generated reviews has significantly undermined user trust. A large-scale analysis conducted by Circuit examined 33.5 million Amazon reviews and found that approximately 43% were likely fake, particularly among top-selling products [2]. Furthermore, surveys indicate that over 75% of consumers are concerned about encountering fake feedback when shopping online [3].

Advances in AI have exacerbated this issue by enabling the creation of synthetic reviews that closely mimic authentic language and tone, making manual detection increasingly difficult [4]. As a result, users are becoming more hesitant to rely on traditional review platforms, and legitimate businesses may suffer reputational damage from manipulated ratings.

There is a clear need for a system that can accurately detect fake reviews, promote transparency, and incentivize honest participation. *BuyWise* addresses this critical issue by combining AI-powered fake review detection with a multilingual, gamified reward system, fostering credibility, user engagement, and trust in online product reviews.

1.3 Project objectives

1.3.1 Main Objective

To develop a reliable, bilingual product review platform that detects computer-generated reviews in real time and motivates users to provide authentic feedback through a structured gamified system of points, levels, badges, and redeemable rewards.

1.3.2 Sub-objectives

- To implement real-time fake review detection using a fine-tuned RoBERTa language model, a robust and optimized variant of BERT tailored for natural language processing. Leveraging advanced training techniques and large-scale datasets, RoBERTa excels at capturing linguistic context and semantics, enabling the system to accurately detect suspicious or AI-generated reviews.
- To develop a point-based incentive system that encourages authentic user participation by awarding badges and level-ups for genuine reviews, displaying dynamic trust badges to enhance content credibility, and allowing users to redeem their points for sponsored rewards through a secure and transparent process.
- To enhance overall platform engagement by allowing users and companies to manage their profiles, publish products, and actively participate in the review ecosystem supported by interactive features such as likes, threaded replies, comment reporting, and real-time notifications that foster trust and meaningful interactions.
- To provide administrators with a centralized and intuitive dashboard for managing users, companies, products, categories, reviews, and reported content ensuring efficient oversight, content moderation, and platform reliability.

1.4 Research strategy (Framework)

BuyWise was developed using the Scrum methodology, to ensure efficient and adaptive development of *BuyWise*, the team implemented Scrum as the core agile methodology. We structured the project into multiple time-boxed sprints, each targeting specific deliverables such as user onboarding, review analysis, fake-review detection, and the reward system. Iterative cycles allowed for continuous stakeholder feedback, frequent demos, and rapid adjustments to our objectives, especially during AI integration and multilingual support development.

Scrum was selected due to its empirical foundation overall emphasis on transparency, inspection, and adaptation making it ideally suited for projects with evolving requirements and complexity. The framework fosters collaboration, accountability, and clear role definition (Product Owner, Scrum Master, Developers), along with essential ceremonies (Sprint Planning, Daily Standups, Reviews, Retrospectives). Ultimately, Scrum enabled consistent value delivery, improved predictability, and timely adjustments within our academic timeline [5].

Further details on the sprint structure and implementation are discussed in Chapter 3

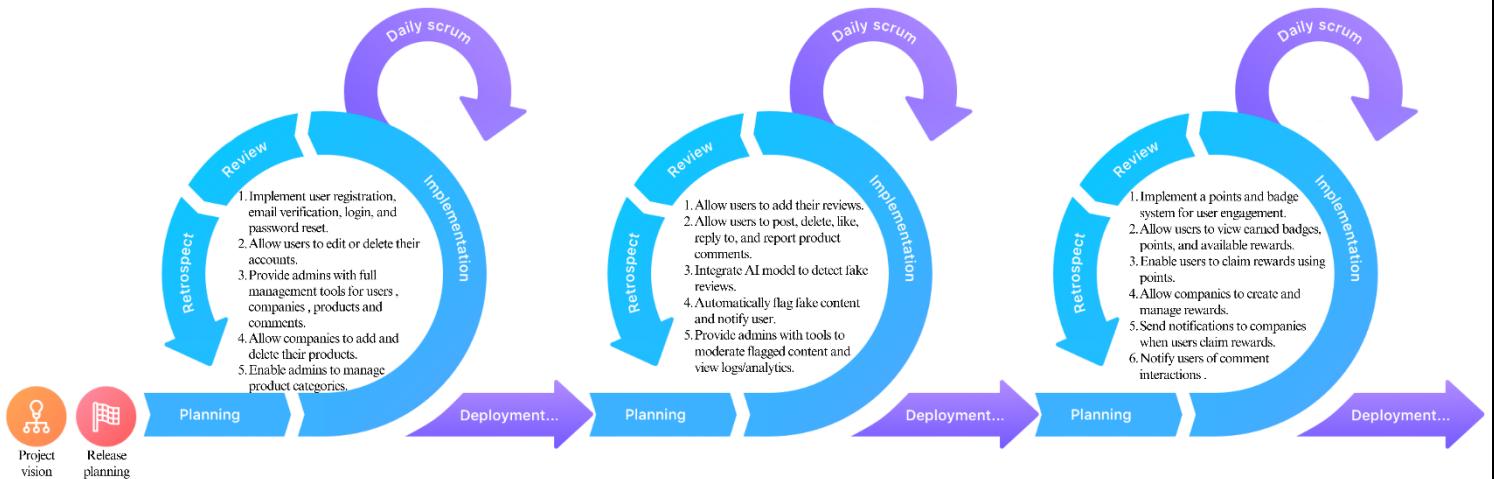


Figure 1.1: Scrum Framework

1.5 Scope (Boundary)

The scope of the *BuyWise* project is centered on developing a fully functional web-based platform that enables interaction between users and companies through product reviews and ratings. The platform is designed to enhance the credibility of online reviews by integrating AI-powered fake review detection alongside a point-based reward system that motivates authentic user engagement.

In Scope:

- User and company registration, login, email verification, and profile management.
- Submission of product reviews, ratings, comments, replies, and like interactions.
- A system of badges, levels, and points to reward and recognize meaningful contributions.
- Integration of AI technology to detect computer-generated reviews using a locally hosted model.
- Multilingual support (Arabic and English) with automatic direction switching (LTR/RTL).
- A notification system for likes, comments, replies, and reward achievements.
- An admin dashboard to manage categories, users, companies, products, comments, and reported content.

Out of Scope:

- A mobile application (the platform is available exclusively via web browsers).
- Real-time messaging or live chat functionality between users.
- Integration with third-party marketplaces or payment gateways (e.g., Amazon, PayPal).

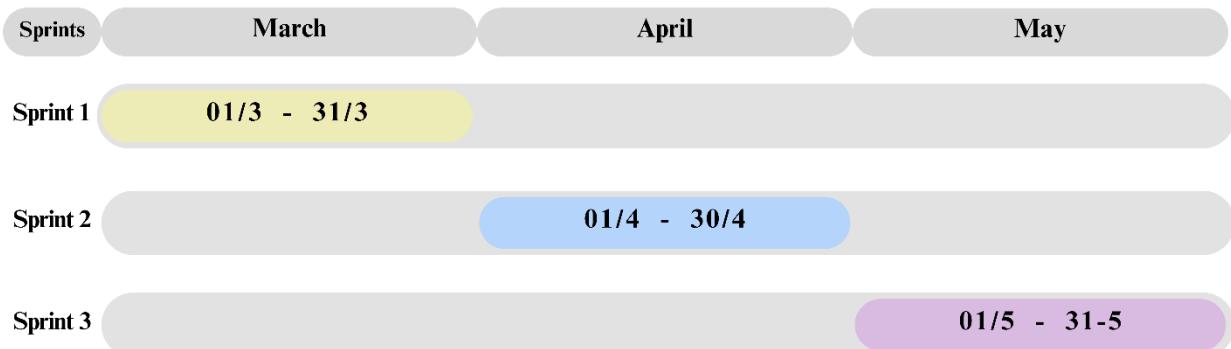
This defined scope ensures that *BuyWise* remains focused, achievable, and aligned with project constraints, while laying a foundation for potential future enhancements.

1.6 Gant chart

The development of the *BuyWise* platform was organized into three structured sprints, distributed across the months of March, April, and May. Each sprint focused on key deliverables aligned with the Scrum methodology, ensuring systematic progress and clearly defined milestones.

The timeline of each sprint is summarized in **Table 1**.

Table 1.1: Sprint Timeline and Key Deliverables (Gantt Chart)



1.7 Project outline

- **Chapter 1:** Introduces the research problem, outlines the project objectives, and describes the research strategy and development methodology.
- **Chapter 2:** Reviews existing product review platforms, analyzes their limitations, and establishes the need for the proposed *BuyWise* system.
- **Chapter 3:** Presents the feasibility study and methodology, outlines the system architecture, and details both functional and non-functional requirements.
- **Chapter 4:** Covers the system design through detailed diagrams, illustrating the overall architecture, structure, and workflow of the platform.
- **Chapter 5:** Describes the implementation process, testing strategies, and evaluation of the system's performance and functionality.
- **Chapter 6:** Concludes with a summary of key findings, discusses challenges encountered, and provides recommendations for future improvements.

Chapter 2 : Literature Review

2.1 Overview

This chapter explores existing review platforms, highlighting their credibility challenges and gaps. It demonstrates how *BuyWise* advances the field through AI-driven moderation, bilingual support, gamified engagement, transparent sponsorship labeling, and dedicated promotion of local products encouraging users to support regional businesses while ensuring review integrity.

2.2 Related Work

Many review platforms attempt to build trust in different ways. This section reviews major examples Yelp, Goodreads, TripAdvisor, CNET, Metacritic, GameSpot, PCMag, Trustpilot, Which?, and G2 focusing on their strengths and comparing their features to *BuyWise* in areas like fake review detection, user engagement, language support, and commercial transparency.

2.2.1 Yelp: Yelp is a platform focused on reviews for local businesses. It uses AI tools and community reporting to help spot and reduce fake reviews [6]. Although it offers badges and an Elite Reviewer program, it does not have a full reward system to keep users engaged long-term. Yelp supports several languages, but it doesn't fully support Arabic or right-to-left (RTL) layouts. Sponsored content is clearly marked, but the platform does little to promote local or regional products. In comparison, *BuyWise* improves this by adding real-time AI fake review detection, full bilingual (English and Arabic) support, a gamified reward system, and strong local product promotion.

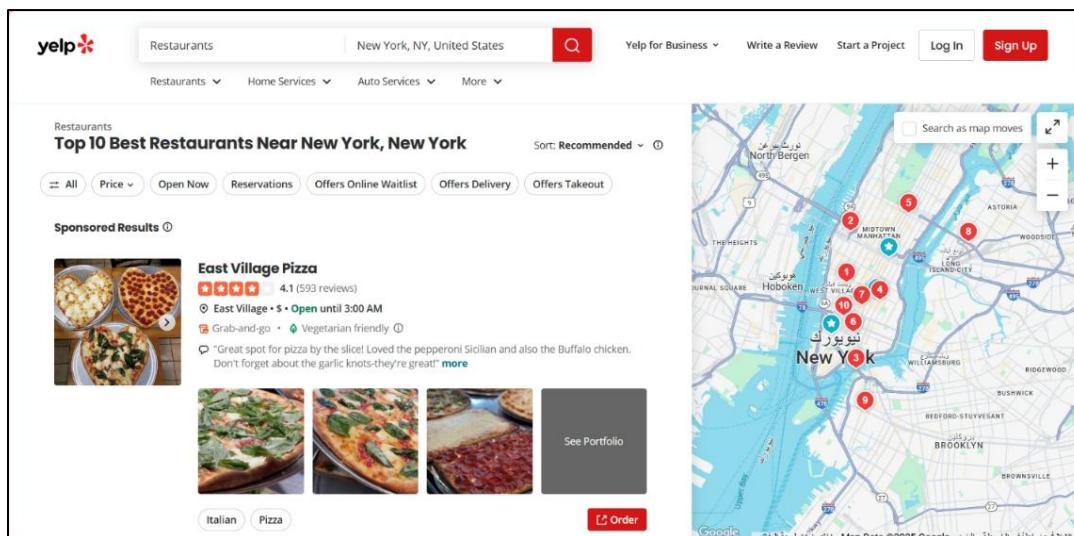


Figure 2.1: Yelp Platform Overview

2.2.2 Goodreads: Goodreads is a platform for book reviews. It relies on community moderation; users report fake or inappropriate reviews but does not use AI for detection [7]. It lacks a reward or badge system, which may reduce user engagement over time. While it supports reviews in multiple languages, it does not fully support Arabic or RTL layout. It also lacks tools for promoting regional or niche books. In contrast, *BuyWise* uses real-time AI moderation, bilingual support, and a reward system to boost engagement across diverse product categories.

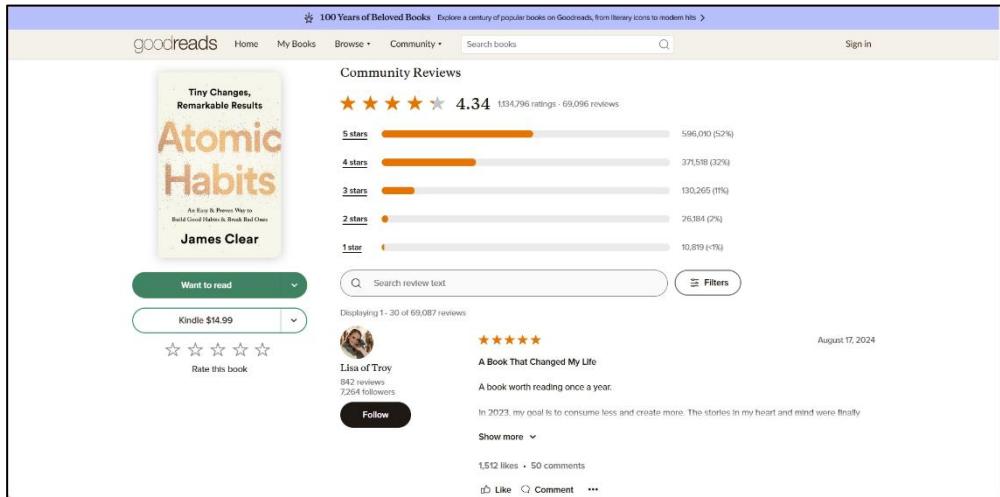


Figure 2.2: Goodreads Platform Overview

2.2.3 TripAdvisor: TripAdvisor is a leading platform for travel and hospitality reviews. It uses both automated tools and manual moderation to remove fake reviews, deleting millions annually [8]. The platform offers points and badges to encourage participation, but they are symbolic and not redeemable. While TripAdvisor supports Arabic and RTL layout and labels sponsored content, it lacks active promotion of local products. *BuyWise* improves on this by adding redeemable rewards, clearer sponsorship transparency, and stronger bilingual support.

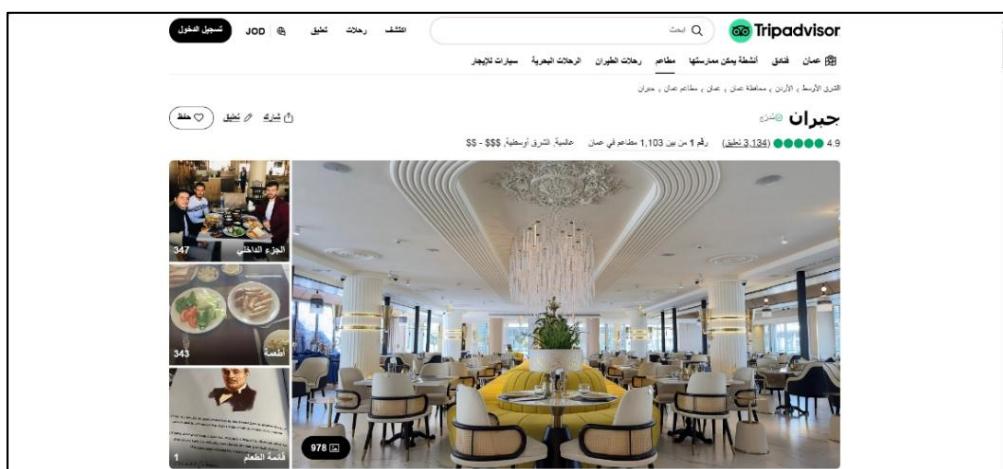


Figure 2.3: TripAdvisor Platform Overview

2.2.4 CNET: CNET is a tech editorial site that offers staff-written product reviews and limited user comments. It does not use AI to detect fake reviews, lacks gamification features, and does not focus on promoting local products. Sponsorship and native advertising are present—and at times have blurred the line between editorial content and ads [9]. Unlike BuyWise, CNET does not support multilingual or user-generated reviews. BuyWise distinguishes itself by enabling AI-verified user reviews, a full bilingual interface, and incentives that reward genuine contributions.

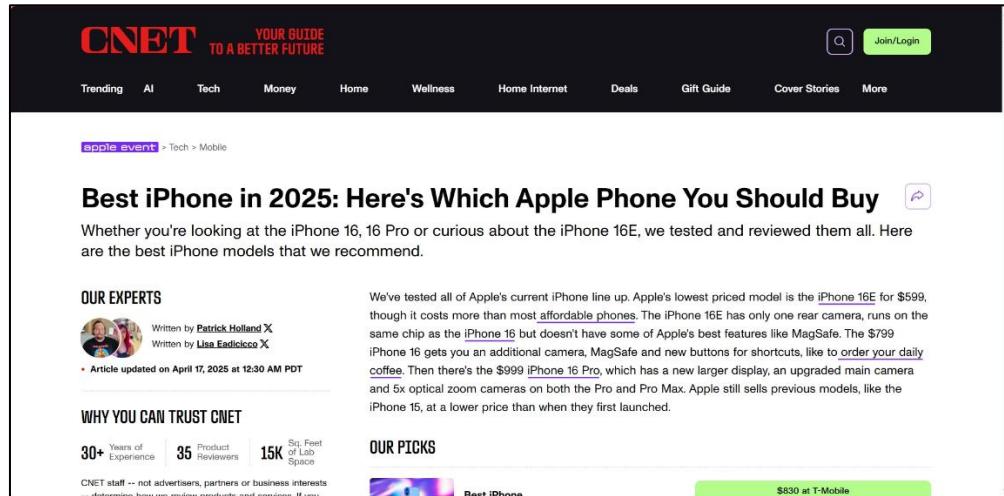


Figure 2.4: CNET Platform Overview

2.2.5 Metacritic: Metacritic aggregates expert and user reviews for entertainment media. It uses basic moderation but lacks AI-based fake review detection, gamification, or multilingual support. The platform is limited to English and does not highlight local products. In contrast, *BuyWise* offers real-time AI verification, bilingual access, gamified rewards, and a focus on local engagement [10].

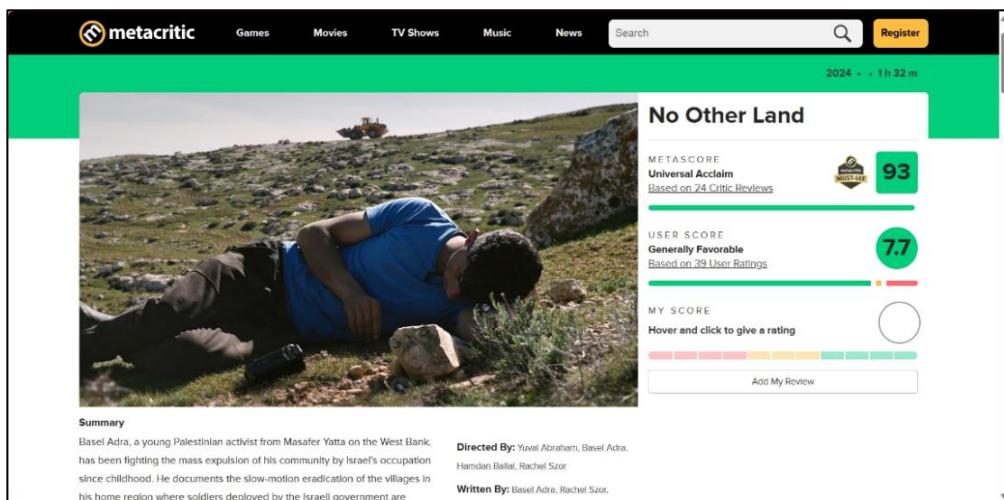


Figure 2.5: Metacritic Platform Overview

2.2.6 GameSpot: GameSpot provides editorial content and community discussions focused on video games. It lacks AI-powered fake review detection, gamification, and multilingual support, though it clearly labels sponsored content. In comparison, *BuyWise* incorporates advanced AI moderation, user rewards, and bilingual accessibility in a user-driven review environment [11].

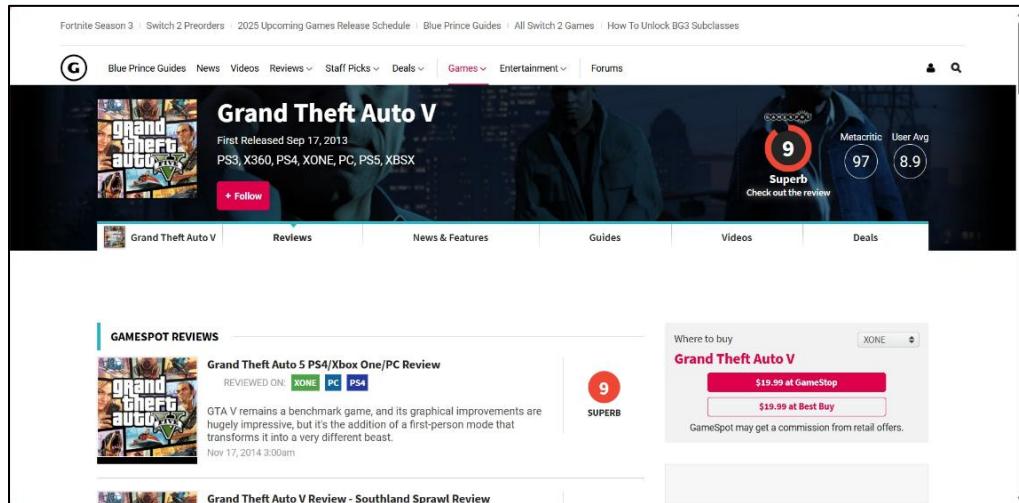


Figure 2.6: GameSpot Platform Overview

2.2.7 PCMag: PCMag is a technology review site known for independent, lab-based product evaluations targeted at consumers and businesses. It does **not** host user-generated reviews, lacks AI for fake-review detection, offers no gamification, and is available only in English. Sponsored content is clearly labeled, but the platform does not actively promote local products. In contrast, *BuyWise* provides a community-driven, AI-verified, bilingual, and gamified review ecosystem that expands beyond PCMag's editorial scope [12].



Figure 2.7: PCMag Platform Overview

2.2.8 Trustpilot: Trustpilot uses AI-driven systems and community reporting to detect and remove fake reviews [13]. The platform supports multiple languages but offers only limited Arabic and RTL layout support. It does not use a points-based gamification system, though sponsored content is clearly labeled. *BuyWise* enhances this by providing full bilingual functionality, a gamified rewards system (including redeemable rewards), and strong local product promotion.

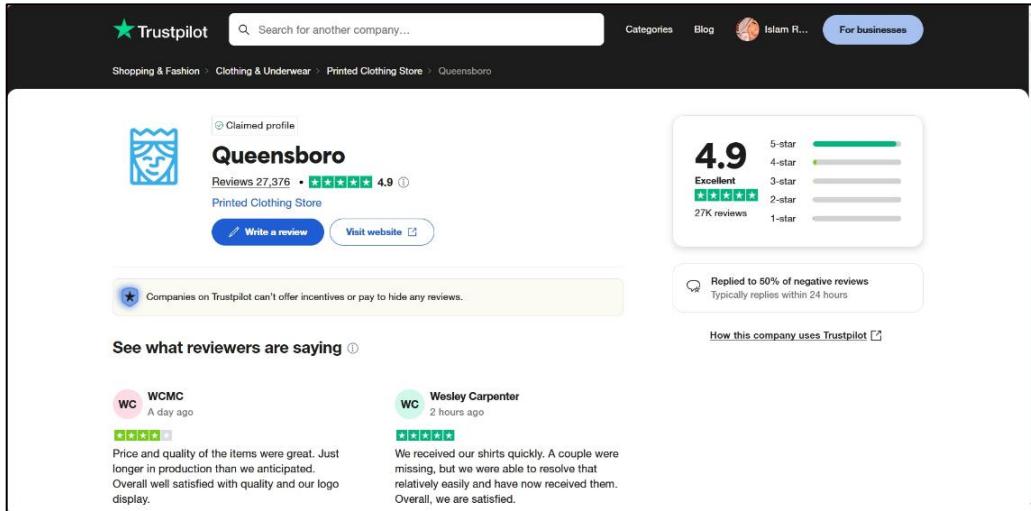


Figure 2.8: Trustpilot Platform Overview

2.2.9 Which?: Which? is a UK-based consumer association offering expert reviews and independent product testing but it does not host user-generated reviews [14]. The platform lacks AI-based fake-review detection, gamification, and multilingual support. Its credibility stems from rigorous lab testing and a transparent, advertisement-free model. In contrast, *BuyWise* combines AI-verified user reviews with engaging gamification and bilingual (English–Arabic) access.

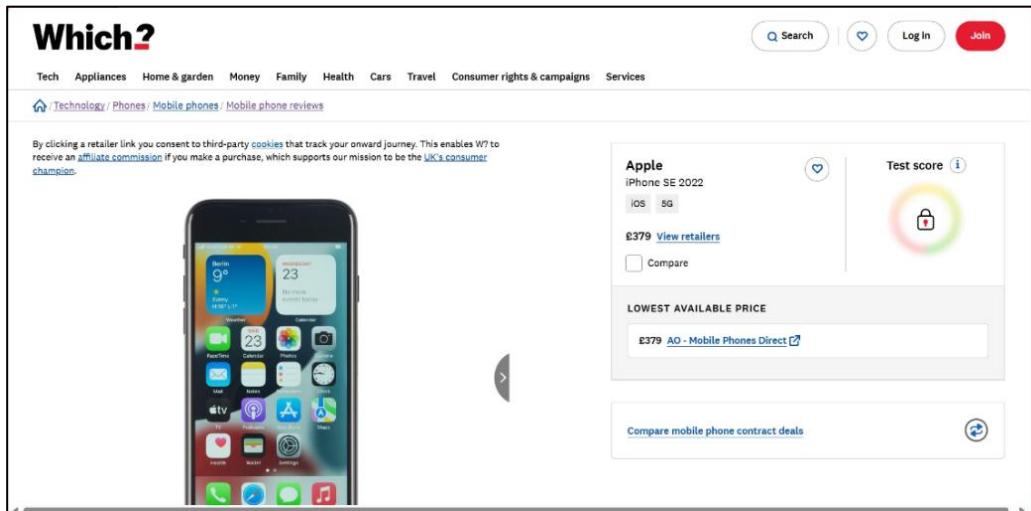


Figure 2.9: Which? Platform Overview

2.2.10 G2: G2 is a review platform focused on B2B software, utilizing identity verification (such as LinkedIn login or business emails) and AI moderation to filter out fake reviews. It offers reputation badges for contributors but does not include a comprehensive gamification system or multilingual support. Sponsored content is clearly labeled. In comparison, *BuyWise* extends this model by adding full bilingual (Arabic–English) functionality, interactive gamified rewards, and a focus on supporting local consumer products.

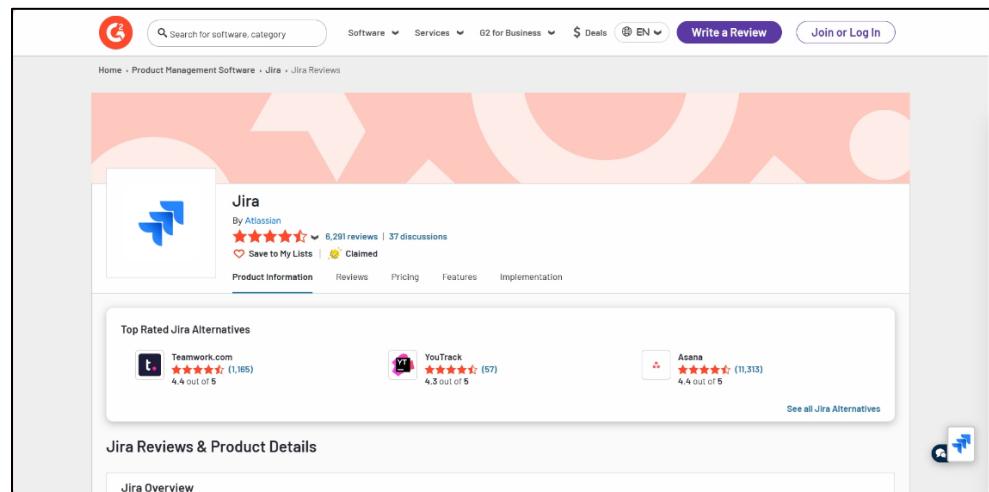


Figure 2.10: G2 Platform Overview

2.3 Comparison of Product Review Platforms

The table below compares *BuyWise* with several existing review platforms based on key features relevant to trust, usability, and innovation.

Table 2.1: Comparison of Key Features Across Product Review Platforms

Platform	AI Fake Review Detection	Gamified Engagement	Bilingual Support	Sponsored Content Labeling	Local Product Rewards	Admin Moderation Tools	Multi-Role Support	Notification & Interaction
BuyWise	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yelp	Yes	Partial	No	Yes	No	Yes	Yes	Yes
Goodreads	Partial	Partial	No	No	No	Yes	No	Yes
TripAdvisor	Yes	Partial	Yes	Yes	No	Yes	Yes	Yes
CNET	No	No	No	No	No	Partial	Yes	Partial
Metacritic	No	No	No	No	No	Yes	No	No
GameSpot	No	No	No	Yes	No	Yes	No	Partial
PCMag	No	No	No	Yes	No	Yes	Yes	Partial
Trustpilot	Yes	Partial	Partial	No	No	Yes	Yes	Yes
Which?	No	No	No	No	No	Partial	Partial	No
G2	Yes	Partial	No	No	No	Yes	Yes	Yes

As shown in **Table 1**, *BuyWise* integrates a comprehensive set of features that enhance review authenticity, user engagement, and platform usability, setting it apart from existing competitors. Notably, *BuyWise* offers full bilingual support and localized product rewards, which many other platforms lack.

2.4 Discussion and Critical Evaluation

This section reviews key techniques used by popular review platforms to ensure credibility, highlights persistent challenges, and explains how *BuyWise* innovates beyond existing systems based on current industry practices.

2.4.1 What Has Been Done in Existing Platforms

Many review platforms have taken important steps to improve trust and user experience. Platforms like Yelp, TripAdvisor, Trustpilot, and G2 use AI technology to detect fake or computer-generated reviews and remove them quickly. Some platforms, like Yelp and TripAdvisor, encourage users by giving badges or recognition, but few offer full reward systems with points and prizes. While a few platforms support multiple languages, including some right-to-left (RTL) languages, full support for Arabic is still rare. Most platforms clearly mark sponsored content, but this transparency isn't consistent everywhere. Very few platforms focus on promoting local products or rewarding users for supporting regional businesses. In general, tools for admins to moderate content and roles for users, businesses, and admins exist, but features for notifications and user interactions vary widely. *BuyWise* improves on all these by combining strong AI detection, full bilingual and RTL support, complete gamification with rewards, clear sponsor labeling, local product promotions, and better user interaction tools.

2.4.2 Issues and Challenges Faced by Other Projects

Despite advancements, existing platforms face ongoing challenges. AI-based fake review detection struggles against increasingly sophisticated computer-generated content, leading to false positives or missed cases. Gamification often lacks depth, with few platforms offering meaningful, redeemable rewards that truly motivate user participation. Language support particularly for Arabic and RTL scripts is insufficient, restricting accessibility for large user groups. Transparency around sponsored content remains inconsistent, sometimes undermining trust. The absence of localized product promotion reduces platform relevance in regional markets. Moderation tools, though advanced, are challenged by volume and complexity of content, risking delays or errors in removing fake or inappropriate reviews. Multi-role support occasionally lacks flexibility to meet diverse stakeholder needs, while notification and interaction features are often basic, limiting user engagement potential.

2.4.3 Critical Evaluation (Gap Analysis)

A clear gap exists between current platform capabilities and the comprehensive, user-centered experience that ***BuyWise*** offers. Most platforms do not combine real-time AI-powered detection of computer-generated reviews with robust gamified systems offering points, levels, badges, and redeemable rewards. Bilingual and RTL language support, especially full Arabic integration, is missing or partial in leading competitors. Transparency in sponsorship labeling varies widely, creating user confusion and trust issues. Local product promotion and rewards a core feature of ***BuyWise*** are almost entirely absent elsewhere. Moderation, while present, is often limited in its integration with user reporting compared to ***BuyWise***. Furthermore, multi-role support and notification systems in existing platforms do not fully support seamless, real-time interaction across users, companies, and admins. ***BuyWise*** addresses these gaps by integrating advanced AI, deep gamification, bilingual design, transparent sponsorship, local business incentives, flexible roles, and comprehensive user engagement tools, positioning it as a next-generation platform.

2.5 Summary

In summary, while existing platforms demonstrate significant efforts in fake review detection and user engagement, critical gaps remain in multilingual support, gamified rewards, sponsorship transparency, local product focus, and integrated user interaction. ***BuyWise*** advances the field by addressing these challenges holistically, offering a more inclusive, transparent, and motivating environment for authentic product reviews and community engagement.

Chapter 3 : Methodology

3.1 Overview

This chapter outlines the methodology used in developing *BuyWise*, highlighting the approach and processes that guided the project's execution. It covers the development strategy, including feasibility analysis, risk assessment, and a step-by-step process based on the Scrum framework. Key activities such as requirements gathering, sprint development, testing, and deployment are presented to show how the project's goals were systematically achieved.

3.2 Feasibility Study

To assess the viability of the BuyWise platform before development, a feasibility study was conducted with a focus on estimating the required development effort. To achieve this, we used the Function Point Analysis (FPA) method — a standardized technique designed to estimate project size, effort, and complexity based on user-visible functionality. By quantifying each system component (inputs, outputs, files, inquiries, and interfaces) according to their complexity, FPA allows for accurate forecasting of development time, cost, and resource allocation.

The counts for each function type, categorized by complexity, are summarized in **Table 3.1**.

Table 3.1: Function Point Counts by Complexity

Direct Measure	Simple	Average	Complex
External Inputs (EIs)	4	4	2
External Outputs (EOs)	0	5	1
External Inquiries (EQs)	1	2	1
Internal Logical Files (ILFs)	3	4	1
External Interface Files (EIFs)	0	1	1

The above table presents the count of different function types, categorized by their complexity level, which serves as the foundation for calculating the total function points and estimating development effort.

Function Point Estimation

The following table presents the standard weights used in Function Point Analysis (FPA), categorized by complexity level. These weights are applied in the calculation column of the next table to estimate the function points for each functionality type in the system.

Table 3.2: Standard Weights Assigned to Function Point Components Based on Complexity

Component	Simple	Average	Complex
External Inputs (EIs)	3	4	6
External Outputs (EOs)	4	5	7
External Inquiries (EQs)	3	4	6
Internal Logical Files (ILFs)	7	10	15
External Interface Files (EIFs)	5	7	10

The following table provides a detailed breakdown of function point calculations based on the identified system functionalities. For each item, we determined the complexity level (Simple, Average, or Complex), then multiplied the number of occurrences (Count) by the standard weight associated with that complexity level. This multiplication is shown in the Calculation (Count \times Weight) column, and the resulting total function points are listed in the final column. These values reflect the relative effort required for each functionality and are used to estimate the overall development effort.

Table 3.3: Function Point Estimation Table

Functionality	Complexity	Calculation (Count \times Weight)	Function Points
Inputs			
User Registration / Login / Reset	Simple	3×2	6
Like / Comment / Report	Average	3×4	12
Product Submission	Complex	1×6	6
Review Submission (with ratings + images)	Complex	1×6	6
Predict Review Validity (AI Input Trigger)	Average	1×4	4
Save User Preferences (Language)	Simple	1×3	3
Total Inputs		37	
Outputs			
Review Summary Output (with badges)	Average	2×5	10
Notification Feed	Complex	1×7	7
Admin Reports & Flag Summary	Average	1×5	5
Public Profile / Points Display	Average	2×5	10
Total Outputs		32	
Inquiries			
Product Search	Simple	1×3	3
Filter / Sort System	Average	2×4	8
View Rewards	Complex	1×6	6

Total Inquiries	17		
Internal Logical Files (ILFs)			
Users Table	Average	1×10	10
Products Table	Average	1×10	10
Companies Table	Average	1×10	10
Company products Table	Average	1×10	10
Reviews & Comments	Complex	1×15	15
Vouchers / Likes / Badges	Simple	3×7	21
Total ILFs		76	
External Interface Files (EIFs)			
AI Fake Review API (RoBERTa)	Complex	1×10	10
Email Verification / PHPMailer	Average	1×7	7
Total EIFs		17	

The **Unadjusted Function Points (UFP)** are calculated as the sum of all function points from inputs, outputs, inquiries, ILFs, and EIFs:

$$UFP = 37 + 32 + 17 + 76 + 17 = 179$$

Value Adjustment Factor (VAF) and Effort Estimation

The Function Point Analysis includes adjusting the Unadjusted Function Points (UFP) using a Value Adjustment Factor (VAF), which accounts for general system characteristics affecting development complexity.

Table 3.4: Value Adjustment Factor (VAF)

#	General System Characteristic	Rating (0–5)
1	Data Communications	3
2	Distributed Data Processing	2
3	Performance Requirements	4
4	Heavily Used Configuration	3
5	Transaction Rate	3
6	On-line Data Entry	4
7	End-user Efficiency	5
8	On-line Update	5
9	Complex Processing	3
10	Reusability	3
11	Installation Ease	3
12	Operational Ease	5
13	Multiple Sites	1
14	Facilitate Change	3

Total ΣFi	47	
-----------	----	--

The VAF is calculated as: $VAF = 0.65 + (0.01 \times 47) = 0.65 + 0.47 = 1.12$

The Adjusted Function Points (AFP) is: $AFP = 179 \times 1.12 = 180.12 \approx 180$

Assuming a productivity rate of approximately **16 Function Points per person-month**, the total effort estimate is:

Effort (pm) = $180/16 = 11.25 = 12$ person-month

3.2.1 Technical Feasibility

BuyWise was developed using a proven and compatible stack: PHP (backend), MySQL (database), HTML/CSS/JavaScript with Bootstrap (frontend), and Python with Flask for the AI fake review detection system. It runs locally on XAMPP and supports AJAX, multilingual interfaces, and real-time interactions. The chosen technologies are open-source, well-supported, and matched the team's skillset ensuring full feasibility within the timeline.

3.2.2 Operational Feasibility

The system is fully functional and meets user needs through intuitive navigation, interactive review features, and responsive design. It supports user roles (user, company, admin), bilingual use (Arabic/English), and moderation tools. Admin dashboards, public profiles, notification panels, and reward tracking are easy to manage making *BuyWise* operationally stable and maintainable by a small team.

3.2.3 Economic Feasibility

The *BuyWise* platform was developed using open-source technologies such as PHP, Python, MySQL, and Bootstrap, thereby avoiding licensing fees and significantly reducing software costs. Development was conducted on personal machines using freely available tools and libraries, with AI components integrated locally to minimize additional expenses.

The estimated costs associated with the platform development are summarized in **Table 3.5**

Table 3.5: Realistic budget table for BuyWise

Cost Category	Estimated Cost (JD)
Development Hardware	450
Dataset Acquisition	0
Software Development & AI Integration	350
Domain Registration	10
Frontend Hosting	20
Backend/API Hosting	20
Cloud GPU (Optional)	50
Total Estimated Budget	900 JD

3.2.4 Legal Feasibility

BuyWise follows basic data protection practices, including password hashing. The system prohibits fake content. Notifications and reporting tools also support ethical transparency. No major legal risks were identified for deployment.

3.3 Risk Analysis

No intelligent or user-driven platform is without risks. Recognizing these risks early in the *BuyWise* project was essential to ensure system reliability, user trust, and maintainability.

Table 3.6 summarizes the key technical and operational risks identified based on the platform's current status, along with the strategies defined to effectively mitigate each of them.

Table 3.6: Key Project Risks and Mitigation Strategies

Risk Category	Example	Potential Impact	Recommended Mitigation
AI Accuracy	RoBERTa model may flag real reviews as fake or miss actual fake ones	Loss of user trust, incorrect moderation	Combine AI with manual review for edge cases
System Performance	Traffic surge or AI load causes slowdowns	Laggy user experience, reduced engagement	Perform load testing and optimize backend/server configuration
Gamification Abuse	Users exploit point systems via fake accounts or loop interactions	Reward system inflation, unfair metrics	Submit Products and comments limit per day
Multilingual UI Issues	RTL (Arabic) layout bugs, text overflow, translation errors	Poor usability for Arabic users, misunderstood labels	Conduct human QA for Arabic UI; fix layout inconsistencies
Admin Resource Limits	Too few moderators or support staff	Slow response to reports and issues	Schedule regular moderation shifts; automate low-priority tasks

3.4 Methodology Process

This section describes the development methodology used for the *BuyWise* platform. Due to the project's complexity and evolving requirements, Agile Scrum fit our project because we were building something innovative with many moving parts—user accounts, review systems, AI detection, rewards, and multilingual support. Having fixed steps like in Waterfall would've limited our flexibility. With Scrum, we were able to adjust quickly, fix issues fast, and make improvements on the go, especially during model training and real-user testing.[16]

Table 3.7: Scrum-based sprint methodology process

Sprint	Key Features / Tasks	Scrum Phases	Deliverables	Duration
Sprint 1	<ul style="list-style-type: none"> - User registration, email verification, login, and password reset implementation. - User account edit/delete. - Admin tools for managing users, companies, products, comments. - Companies can add/delete products. - Admin management of product categories 	<ul style="list-style-type: none"> Sprint Planning Daily Scrum Development (Analyze, Design, Code, Test) Sprint Review Retrospective 	<ul style="list-style-type: none"> - Working user auth system - Admin dashboard for user/product management - Company product management - Tested & deployed features 	4 weeks
Sprint 2	<ul style="list-style-type: none"> - Enable users to add reviews. - Post, delete, like, reply to, and report comments. - Integrate AI for fake review detection. - Auto-flag fake content and notify users. - Admin tools to moderate flagged content and view analytics/logs. 	<ul style="list-style-type: none"> Sprint Planning Daily Scrum Development (Analyze, Design, Code, Test) Sprint Review Retrospective 	<ul style="list-style-type: none"> - Review & comment system with interaction - AI fake review detection integrated - Admin moderation & analytics tools 	4 weeks
Sprint 3	<ul style="list-style-type: none"> - Points and badge system for engagement. - View earned badges, points, and rewards. - Claim rewards using points. - Companies create/manage rewards. - Notifications for companies and users regarding rewards and comment interactions. 	<ul style="list-style-type: none"> Sprint Planning Daily Scrum Development (Analyze, Design, Code, Test) Sprint Review Retrospective 	<ul style="list-style-type: none"> - Gamification system fully implemented - Reward claiming mechanism - Notification system - Tested and released gamification features 	4 weeks

3.4.1 Requirements Gathering

At the outset of the project, the team conducted **comprehensive theoretical research** to gather system requirements. This process was guided by the **literature review** discussed in **Chapter 2** and supported by a detailed **comparative analysis** of existing product review platforms.

This approach enabled the team to identify essential functionalities and uncover critical gaps in current solutions particularly in areas such as review authenticity, user engagement, and content moderation. These gaps played a central role in shaping the design objectives and development priorities of the ***BuyWise*** platform.

Functional Requirements:

The following table lists the key functional requirements identified for the ***BuyWise*** platform, including their descriptions and priority levels.

Priority values: - M = Mandatory - O = Optional

Table 3.8: Functional Requirements

ID	Functional Requirement	Description	Priority
FR1	User registration with email verification	Let users register and verify emails for account authenticity.	M
FR2	User login and password reset	Allow secure login and password recovery.	M
FR3	Account editing and deletion for users	Enable users to update or delete their accounts.	M
FR4	Admin management of users, companies	Admin tools to manage users, companies, products, and comments.	M
FR5	Company product submission and deletion	Let companies add or remove products.	M
FR6	Admin control over product categories	Allow admins to manage product categories.	M
FR7	User review submission	Enable users to write and submit product reviews.	M
FR8	Commenting system	Allow users to interact with comments (add, delete, like, reply, report).	M
FR9	AI-powered fake review detection	Use AI to detect and flag fake reviews.	M
FR10	Auto-flag suspicious reviews and notify	Flag suspicious reviews and notify users.	M
FR11	Admin moderation of flagged reviews	Provide admins tools to review and act on flagged content.	M
FR12	Points and badge system	Reward users with points and badges for contributions.	M
FR13	View badges, points, and rewards	Show users their badges, points, and rewards.	M
FR14	Reward claiming system	Allow users to redeem points for rewards.	M
FR15	Company reward management portal	Let companies create rewards.	M
FR16	Notify companies on reward claims	Alert companies when rewards are claimed.	O
FR17	Real-time user notifications	Notify users instantly about comments, likes and replies.	M

Non-Functional Requirements:

The following table outlines the key non-functional requirements for the *BuyWise* platform, focusing on usability, security, and responsiveness.

Table 3.9: Non-Functional Requirements

ID	Requirement	Description
NFR.1	Responsive Design	The user interface must dynamically adapt to all device types and screen sizes, including desktops, tablets, and smartphones, ensuring a smooth and consistent user experience across platforms.
NFR.2	Data Privacy and Security	User, company and admin passwords must be securely protected using the PHP password_hash() function, which applies industry-standard hashing (bcrypt) to prevent unauthorized access and ensure data confidentiality.
NFR.3	Ease of Use	<i>BuyWise</i> should offer an intuitive and user-friendly interface that allows users, companies, and admins to easily navigate and complete tasks like posting reviews, managing products, and redeeming rewards without requiring training.
NFR.4	Performance and Scalability	The platform should maintain fast response times even under high user activity, such as multiple concurrent reviews or product uploads. The system must also scale to support increasing numbers of users, reviews, and product listings without performance degradation.
NFR.5	Availability and Reliability	BuyWise should be accessible to users at all times, with minimal downtime. Critical features such as login, commenting, and reward claiming must be consistently available and tested to handle server or network issues gracefully.
NFR.6	Maintainability and Modularity	The codebase should be organized into modular components (e.g., user management, review system, AI detection) to allow easy updates, debugging, and future enhancements without affecting unrelated parts of the system.

3.4.2 Sprint Planning

Before each sprint, the team selected a subset of items from the Product Backlog to form the **Sprint Backlog**. For example:

- **Sprint 1:** Account system (registration, login, password reset)
- **Sprint 2:** Product submission, review form, fake review detection
- **Sprint 3:** Notifications, reward system, company dashboard

Each task was broken down into manageable pieces with clear effort estimation and ownership.

3.4.3 Sprint Execution

During the sprint, the team executed the planned work through continuous collaboration. The sprint included:

- **Analysis:** Clarifying features (e.g., how comment reporting should work)
- **Design:** Creating layouts for public profiles, admin dashboards, popups
- **Implementation:** Coding using PHP, JavaScript, MySQL, Python (AI), HTML/CSS
- **Testing:** Unit and integration tests to ensure functionality and bug fixes

BuyWise features were developed iteratively in each sprint cycle.

3.4.4 Daily Scrum

Each day, the team held short **Daily Scrum** meetings (also called Daily Standups) lasting approximately 15 minutes. Over the course of 3 months (roughly 29 working days per month), this resulted in approximately **87 daily scrums** (29 days × 3 months).

During each standup, team members shared:

- What they completed (e.g., finished language switching logic)
- What they would work on next (e.g., implement report comment modal)
- Any blockers (e.g., issue with displaying fake review badge in RTL)

This routine ensured continuous team alignment, fostered transparency, and facilitated quick identification and resolution of challenges.

3.4.5 Sprint Review

At the end of each sprint, the team demonstrated completed features to the supervisor or mentor.

Examples include:

- Working fake review detection system with RoBERTa
- Fully functional reward and badge system
- Responsive RTL layout with Arabic translations

The Product owner gave feedback on usability and improvements, which were considered for the next sprint.

3.4.6 Sprint Retrospective

After the Sprint Review, the team conducted a **Sprint Retrospective** to reflect on the sprint. They discussed:

- What went well (e.g., modular file structure improved maintainability)
- What could improve (e.g., image upload validation was missed early)
- Action items for future sprints (e.g., improve early testing coverage)

This fostered continuous improvement throughout the *BuyWise* development.

3.4.6 Increment Delivery

After each sprint, *BuyWise* had a **working, testable increment** such as a complete user profile system or a company dashboard. These increments were integrated, versioned, and ready for final deployment by the end of the project cycle.

3.5 Dataset

The Fake Reviews Dataset is a collection of approximately 40,000 product reviews with balanced classes (about 20,000 real and 20,000 fake reviews). The dataset is available on Kaggle and was published in 2022.

Each review entry in the dataset includes the following attributes:

1. Category

Indicates the product category associated with the review (e.g., *Home and Kitchen*, *Electronics*, etc.).

2. Rating

The star rating provided by the reviewer, represented as a **floating-point number** (e.g., 4.0, 5.0).

3. Label

The ground truth label for the review's authenticity:

- o "OR" – Original Review (genuine human-written review)
- o "CG" – Computer-Generated (AI-generated or fake review)

4. Text

the full text of the review. This is the content we analyze to determine if a review is real or fake.

category	rating	label	text_
Home_and_Kitchen_5	5.0	CG	Love this! Well made, sturdy, and very comfortabl...
Home_and_Kitchen_5	5.0	CG	love it, a great upgrade from the original. I've ...
Home_and_Kitchen_5	5.0	CG	This pillow saved my back. I love the look and fee...
Home_and_Kitchen_5	1.0	CG	Missing information on how to use it, but it is a ...
Home_and_Kitchen_5	5.0	CG	Very nice set. Good quality. We have had the set f...

Table 3.10: Preview of the Fake Reviews Dataset showing its columns.

3.5.1 Data Collection and Preprocessing

A labeled dataset of 40,432 product reviews (20,216 real and 20,216 fake) was used to train and evaluate machine learning models. The fake reviews were computer-generated, while the real ones were collected from verified sources. Each review was preprocessed by removing stop words, punctuation, and converting text to lowercase. Tokenization was handled using the Hugging Face tokenizer for transformer models and standard vectorization (TF-IDF) for classical models.

3.6 Model Training and Evaluation

Multiple models were trained and evaluated to determine the most effective one for detecting fake reviews. The models include:

- Logistic Regression
- Random Forest
- Support Vector Machine (SVM)
- BiLSTM (Bidirectional Long Short-Term Memory)
- TinyBERT
- RoBERTa

Each model was trained on the same dataset and evaluated using metrics such as accuracy, precision, recall, and F1-score. Cross-validation was used to ensure the results were consistent and not overfitted to a specific data split.

3.7 Model Deployment

After evaluating all models, RoBERTa was selected due to its superior performance in capturing contextual language and detecting fake reviews with high precision. The final model was fine-tuned and deployed using a Flask-based API. The web application sends user-submitted reviews to this API, which returns a prediction (real or fake) in real time.

Chapter 4 : Design Models

4.1 Overview

This chapter presents the system design of the *BuyWise* platform. It covers the visual and structural representation of how the platform works, how users interact with it, and how data flows through the system. The chapter includes the context diagram, data flow diagram, use case diagram, ER diagram, and relational model. These components help visualize the system's processes, user roles, database structure, and how different parts of the platform are connected and function together.

4.2 Context Diagram – Level 0

This diagram shows the overall interaction between the *BuyWise* system and external actors. It highlights how users, companies, and admins communicate with the system.

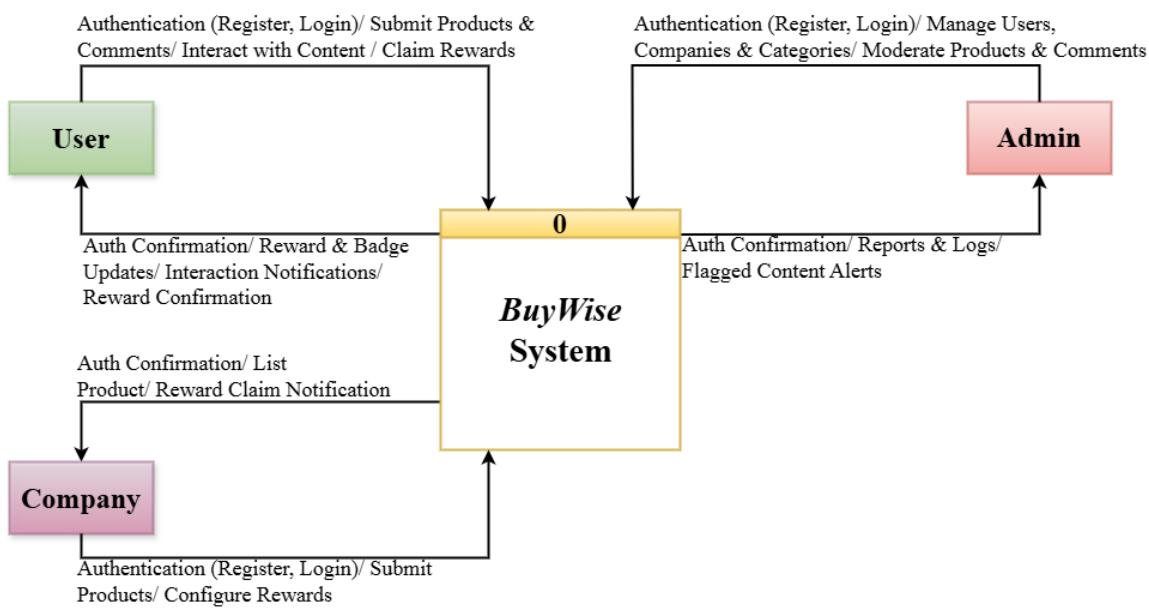


Figure 4.1: Context Diagram – Level 0

4.3 Data Flow Diagram - Level 1

This diagram shows the internal workflow of the *BuyWise* system. It breaks down the main tasks and shows how these tasks connect to the database to store or retrieve information.

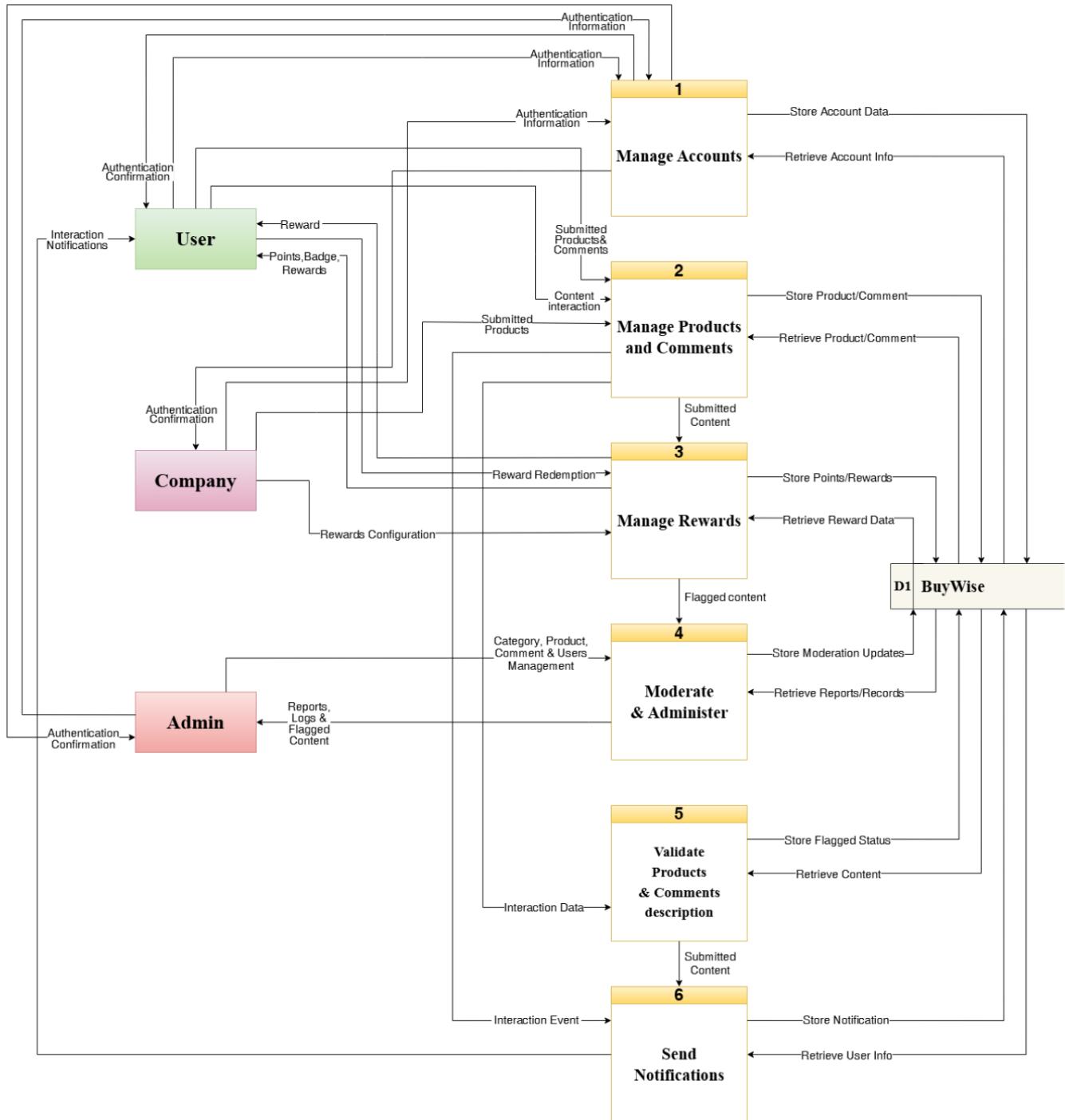


Figure 4.2: Data Flow Diagram - Level 1

4.4 Use Case Diagram

This diagram shows what each type of user can do in the *BuyWise* system. It includes actions for users, companies, and admins. The diagram helps explain who can access which features.

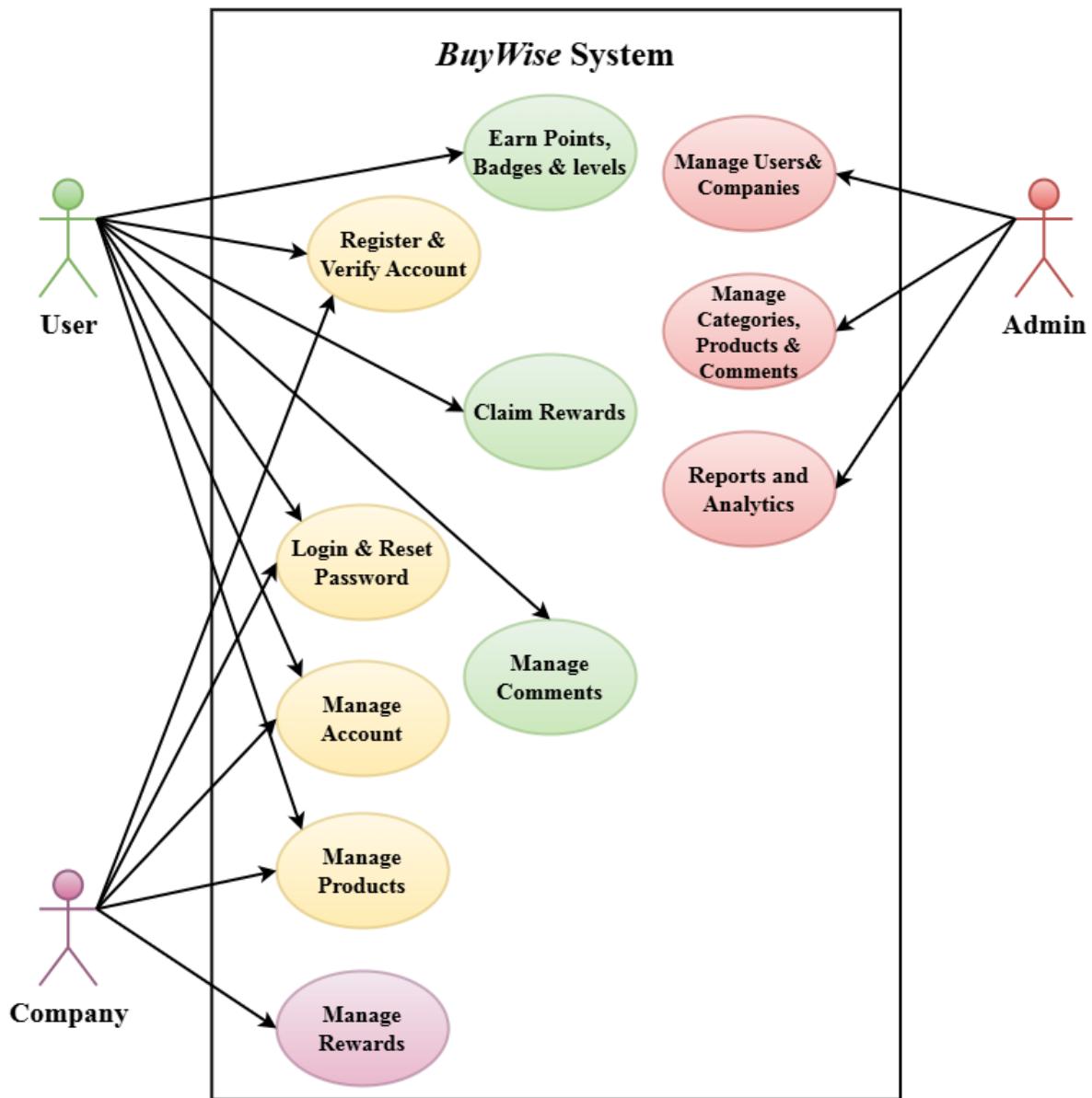


Figure 4.3: Use Case Diagram

4.5 ER Diagram

This diagram shows how the main parts of the *BuyWise* database are connected. It helps explain the structure of the data and the relationships between the entities features.

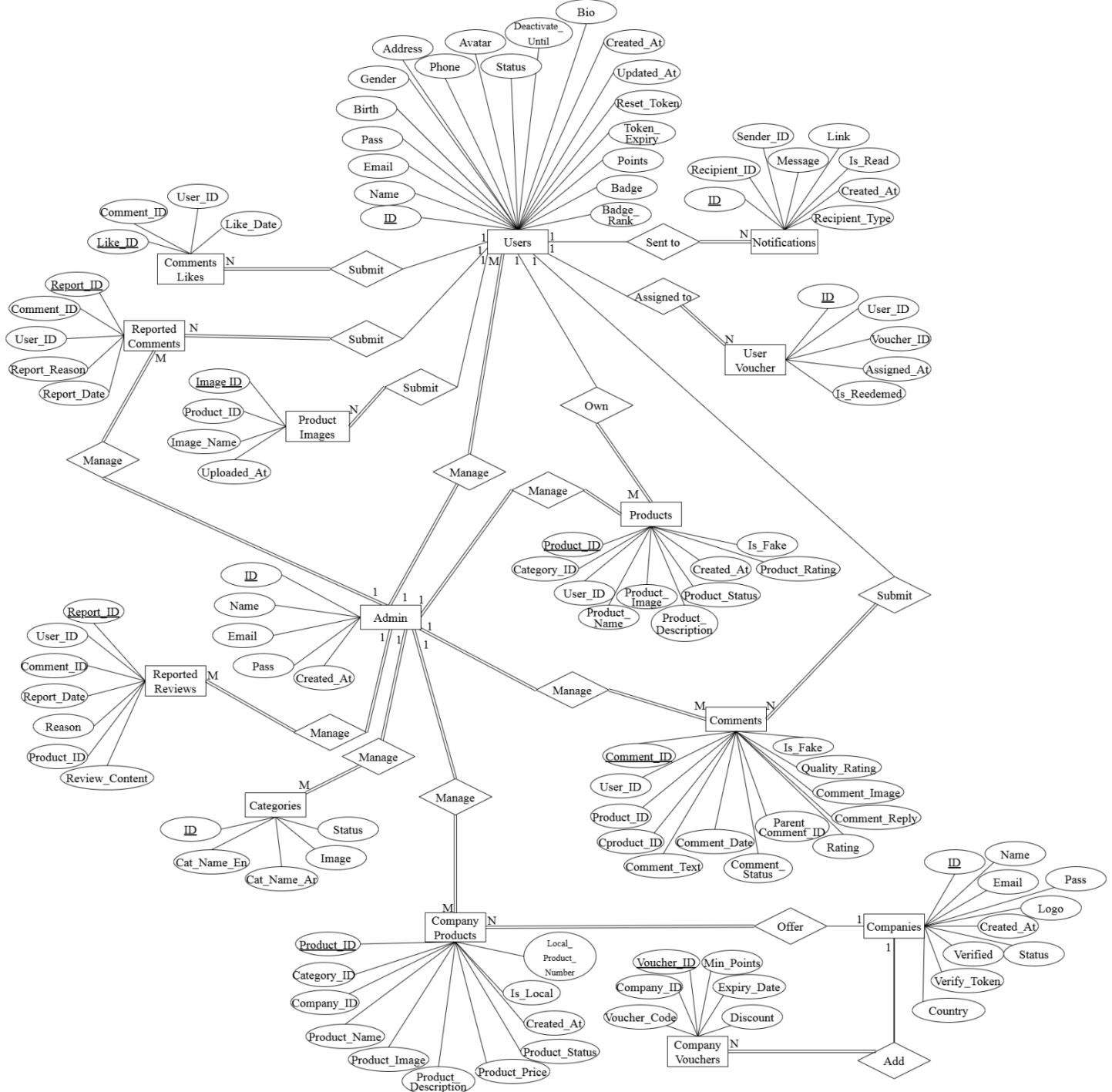


Figure 4.4: ER Diagram

4.6 Relational Model

The relational model represents the logical structure of the *BuyWise* database using tables, columns, and keys. It shows how data is organized, how different entities are related through foreign keys, and how integrity is maintained across the system. This model provides a clear foundation for implementing the database in a real-world environment.

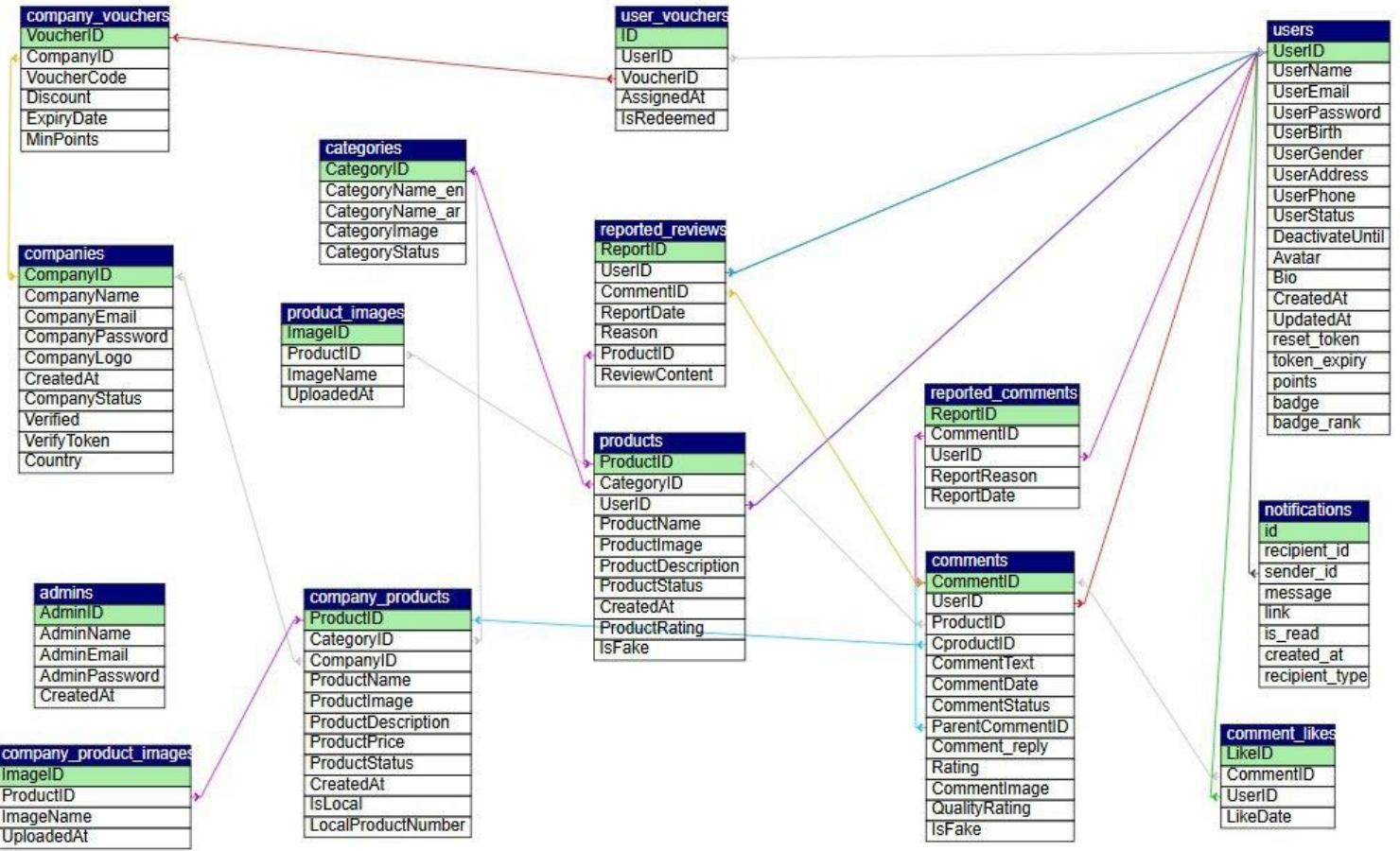


Figure 4.5: Relational Model

Chapter 5 : Experiments And Results

5.1 Overview

This chapter explains the testing strategy used in the development of the *BuyWise* platform to ensure that all features work correctly, efficiently, and reliably. Following the Agile Scrum methodology, testing was integrated into each sprint. Every new feature was tested both individually and as part of the full system to ensure smooth operation. The testing process helped maintain high quality throughout the platform's development.

5.2 Testing Methodologies

To confirm the functionality and stability of the platform, *BuyWise* adopted a structured, multi-level testing approach:

- **Unit Testing:** Checked individual components like forms, notifications, and rating calculations to ensure they worked as expected in isolation.
- **Integration Testing:** Verified that modules such as review submission and rewards worked well together and shared data correctly.
- **System Testing:** Assessed the full platform experience from a user's point of view, simulating real-world interactions.

These methods were applied throughout development to ensure each part of the system was reliable and ready for deployment.

5.2.1 Unit Testing Results

Unit testing was done during every sprint to validate key features before they were connected to other parts of the system.

- **Sprint 1:** Focused on user registration, login, and email verification
- **Sprint 2:** Covered product submission, comments, ratings, and user interactions
- **Sprint 3:** Tested fake review detection, points and badge logic, reward claiming, and notifications

Each unit test involved validating both valid and invalid inputs, edge cases, and expected system behavior. Most functions performed as intended, and any issues were identified and resolved promptly. A detailed breakdown of unit testing results for all three sprints is provided in **Table 5.1**, **Table 11**, and **Table 12** below.

Before diving into the test cases, **Table 10** presents the unit testing results for Sprint 1. This sprint primarily focused on core user authentication, registration, and session management functionalities.

Table 5.1: Unit Testing Results – sprint 1

Test ID	Test Case	Input	Expected Result	Actual Result	Error Found	Action
UT-01	Register new user with valid data	Valid name, email, password	Account created, redirected	Success	No	N/A
UT-02	Register with duplicate email	Already used email address	Error shown, registration blocked	Account created	Yes	Yes – Check added
UT-03	Login with invalid credentials	Wrong password	Login fails, error shown	Error shown	No	N/A
UT-04	Session timeout	Idle after login	Session expires; user must re-login	Session expired	No	N/A

Table 5.2 details the unit tests performed during Sprint 2, which involved product and comment management functionalities, including validations for comments and interactions.

Table 5.2: Unit Testing Results – sprint 2

Test ID	Test Case	Input	Expected Result	Actual Result	Error Found	Action
UT-05	User adds product	Complete product form	Product created and listed	Success	No	N/A
UT-06	Missing fields during creation	Empty required fields	Validation error shown	Error shown	No	N/A
UT-07	Submit comment with rating	5-star rating and comment text	comment saved and listed	Success	No	N/A
UT-08	Submit empty comment	No rating or comment	Submission blocked	Error shown	No	N/A
UT-09	Very short comment	Excessively short text	Input rejected Error shown	Error shown	No	N/A
UT-11	Reply to a comment	Nested reply	Reply saved under comment	Success	No	N/A
UT-12	Guest attempts comment	Not logged in	Access denied	Comment added	Yes	Yes – Guest blocked
UT-13	Like a comment	User likes a comment	Like count increases	Success	No	N/A
UT-14	Report a comment	Choose reason and confirm	Comment flagged for admin	Success	No	N/A

UT-15	Duplicate report	Report same comment twice	Second report blocked	Allowed	Yes	Yes – Duplicate blocked
UT-16	Submit fake review	Spammy content	Rejected	Review flagged	No	N/A
UT-17	Submit normal review	Honest feedback	Accepted	Success	No	N/A
UT-19	View reported content	Access report list	Admin can act on flagged content	Success	No	N/A
UT-20	Non English Review	Review written in non-English	Prediction Returned (real or fake)	No prediction returned	Yes	No

Lastly, **Table 5.3** summarizes unit testing results from Sprint 3, highlighting notifications, reward claiming, and gamification-related features.

Table 5.3: Unit Testing Results – sprint 3

Test ID	Test Case	Input	Expected Result	Actual Result	Error Found	Action
UT-21	New comment notification	Someone comments on your review	Notification appears	Success	No	N/A
UT-22	Like notification missing	Someone likes your comment	Notification should appear	No notification	Yes	Yes – Feature added
UT-23	Points increase on review submission	User posts a high-quality review	User receives points and badge progress updated	Points and badge updated	No	N/A
UT-24	View badge on profile	Navigate to profile after posting	Badge and point total shown visibly	Displayed correctly	No	N/A
UT-25	Claim reward with enough points	Click on a reward, confirm claim	Reward marked as claimed, points deducted	Reward claimed and points deducted	No	N/A
UT-26	Claim reward with not enough points	Click on a reward with low points	System blocks claim, not allow user to click	Claim Button not active	No	N/A
UT-27	Company receives reward claim alert	User redeems a company's reward	Company receives notification	Notification received	No	N/A

5.2.2 Integration Testing Results

Integration testing ensured that features developed across different sprints worked together seamlessly. These tests simulated real user interactions and verified that data flowed correctly between interconnected modules.

Integration Testing: Sprint 1 + Sprint 2

All modules integrated successfully. Reviews triggered AI-based analysis, and flagged content was properly routed for admin moderation. No data loss or system conflicts were observed. The detailed outcomes are summarized in **Table 5.4**

Table 5.4: Integration Testing Results – sprint 1 + 2

Test ID	Test Case	Modules Tested	Test Description	Expected Outcome	Actual Outcome	Status
INT-01	Registered User Posts Comment	Auth, Comments, AI	User signs up and posts a comment on a product.	Comment saved → AI scans → If flagged, rejected and sent to admin.	Comment submitted successfully, AI flag worked as expected.	Pass
INT-02	Product Owner Posts Self-Review	Products, AI	User creates a product and reviews it.	Review linked and analyzed by AI, then listed under the product.	Displayed properly, marked as authentic.	Pass
INT-03	Admin Handles Reported comment	Admin Panel, Comments	Admin reviews and deletes reported comment.	Review removed from UI, record updated in database.	Admin action reflected immediately.	Pass

Integration Testing: Sprint 1 + 2 + 3

The complete system functioned smoothly. Actions such as review submissions correctly updated points and badge progress. Reward claims triggered appropriate notifications and updated the company dashboard as expected. A full overview of results is presented in **Table 5.5**

Table 5.5: Integration Testing Results – sprint 1 + 2 + 3

Test ID	Test Case	Modules Tested	Test Description	Expected Outcome	Actual Outcome	Status
INT-05	Comment Adds Points	Comments, Points, Profile	User posts comments on products.	Points increase → Profile updates.	Points added correctly and shown in UI.	Pass
INT-07	Like Notification Trigger	Likes, Notifications	Another user likes a comment.	Notification delivered to author.	Notification shown in dropdown and redirected to the comment.	Pass
INT-08	Report Appears in Admin Moderation Panel	Reports, Admin Panel	User reports a comment.	Admin sees the report, reason, and can act.	Moderation dashboard displayed report correctly.	Pass
INT-09	Reward Redeemed by Eligible User	Points, Rewards, Vouchers	User accumulates 100+ points and claims a reward.	Points deducted → Reward shown in vouchers.	Redeemed successfully, confirmed in both user and company views.	Pass
INT-10	Company Receives Claim Notification	Rewards, Company Notifications	User claims a company-sponsored reward.	Company notified with user details and reward info.	Notification reached company dashboard.	Pass

5.2.4 Acceptance System Results

To evaluate the usability, functionality, and satisfaction level of the *BuyWise* platform, a User Acceptance Testing (UAT) survey was conducted with 20 participants from the intended user base. The survey used a 5-star rating system, where 1 star represented *very poor* and 5 stars indicated *excellent* performance.

The questions were divided into two primary categories:

- **Effectiveness:** Focused on users' ability to complete core platform tasks such as registration, product interaction, and reward understanding.
- **Efficiency:** Assessed speed, responsiveness, reliability, and interface usability.

Each participant rated the platform across 11 criteria.

Table 5.6: Average UAT Ratings by Tested Area

#	Category	Tested Area	Average Rating (out of 5)
1	Effectiveness	Account Registration	4.35
2	Effectiveness	Product Browsing	4.40
3	Effectiveness	Review Submission	4.40
4	Effectiveness	Commenting Features	4.30
5	Effectiveness	Reward System Clarity	4.05
6	Effectiveness	Reuse & Recommendation	4.45
7	Efficiency	Language Switching	4.50
8	Efficiency	Platform Responsiveness	4.30
9	Efficiency	Error-Free Experience	3.95
10	Efficiency	Visual Design Comfort	4.30
11	Efficiency	Overall Platform Usability	4.25

Conclusion

The results of the *BuyWise* UAT demonstrate high user satisfaction, with all tested areas scoring above 3.9 stars. Participants found the platform to be clear, functional, and responsive. While open-ended feedback was not gathered in this phase, the quantitative results affirm the platform's reliability and user-friendliness. This data provides a solid foundation for finalizing the current version and planning future improvements.

5.3 Discussion and Evaluation

The testing results of the *BuyWise* platform show that the system works well, both technically and from the user's point of view. By testing each feature in every sprint, the team was able to find and fix problems early. This helped keep the quality of the platform high during development.

Technical Performance

Unit testing confirmed that key features like user registration, login, product submission, commenting, and reward claiming worked as expected. Any issues (such as duplicate reports or missing notifications) were small and were fixed quickly. This shows that each part of the system was built correctly.

Integration testing showed that different parts of the system worked well together. For example, when a user submitted a review, the AI could check if it was fake. Points were updated when users interacted, and reward claims sent alerts to companies. This means the system's modules shared data smoothly and accurately.

User Satisfaction

The User Acceptance Testing (UAT) results were also very positive. Twenty users rated the platform across 11 areas using a 5-star scale. All areas scored above 3.9 stars, which shows strong satisfaction. The highest scores were for language switching (4.50) and reuse & recommendation (4.45), which means users found it easy to use and helpful.

The lowest rating was 3.95 for error-free experience. This suggests that while the platform is stable, some users may have encountered minor issues and could benefit from additional testing or user support features.

Overall Conclusion

In summary, the *BuyWise* platform is technically strong, user-friendly, and performs as expected.

The testing process confirmed that:

- Features work correctly on their own and together
- Users had a positive experience using the platform
- The system is ready for real use but can be improved in small ways, such as adding clearer guidance for the reward system and addressing minor usability issues like error handling.

These results give the team confidence that *BuyWise* is a stable, practical, and well-designed system that meets its goals and provides a strong foundation for future enhancements.

5.4 Evaluation Metrics

The confusion matrices provide a visual summary of each model's prediction performance on the binary classification task—distinguishing between real and fake reviews. From top-left to bottom-right, the matrices correspond to the outputs of Random Forest, SVM, BiLSTM, Logistic Regression, TinyBERT, and RoBERTa. In each matrix:

- Diagonal cells represent correct predictions (real-real and fake-fake),
- Off-diagonal cells represent misclassifications (false positives and false negatives).

Traditional models such as Logistic Regression and SVM achieved moderate performance, with SVM slightly outperforming Logistic Regression. However, both models struggled with false positives and false negatives. Random Forest had the weakest results, generating numerous false positives by incorrectly labeling genuine reviews as fake.

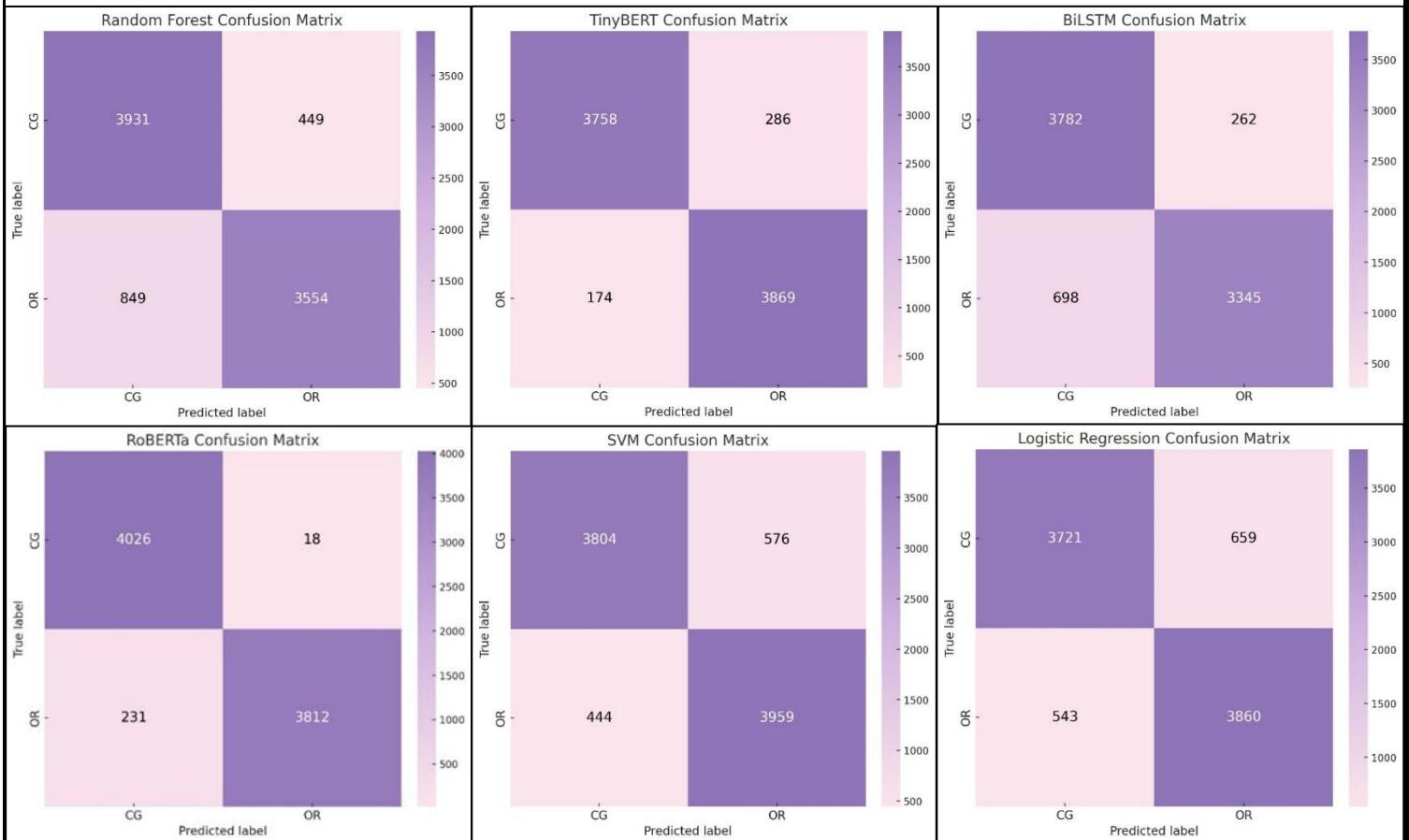


Figure 5.1 : Confusion Matrices for All Models

5.5 Model Performance Comparison

In this project, we evaluated six different models to classify product reviews as real or fake. The models fall into two main categories:

- **Traditional Machine Learning Models:**
 - Logistic Regression
 - Support Vector Machine (SVM)
 - Random Forest
- **Neural Network and Transformer-Based Models:**
 - BiLSTM (Bidirectional Long Short-Term Memory)
 - TinyBERT
 - RoBERTa

Each model was evaluated using two main metrics:

- **Accuracy:** The percentage of correct predictions.
- **ROC AUC (Receiver Operating Characteristic – Area Under the Curve):** A metric that measures how well the model separates the two classes (real vs fake).

1. Support Vector Machine (SVM)

A classic ML model that tries to separate real and fake reviews by drawing the best boundary between them. It performs well on simple data but is limited in understanding complex language patterns.

2. Logistic Regression

A fast and simple classification model. It detects patterns in word usage to predict if a review is real or fake. However, it doesn't handle word meanings or sentence context well.

3. Random Forest

An ensemble model made of many decision trees. Each tree makes a prediction, and the final output is based on majority vote. It is good for basic pattern recognition but lacks deep language understanding.

4. BiLSTM (Bidirectional LSTM)

A type of neural network that processes text both forward and backward. It's better than traditional models at capturing sentence structure and context, but still less effective than transformer models.

5. TinyBERT

A lightweight, faster version of BERT. It offers a balance between speed and accuracy, performing well on language tasks even with limited computational resources.

6. RoBERTa

An improved version of BERT, trained on a larger dataset and for a longer time. RoBERTa deeply understands language context and consistently outperformed all other models in our experiments. It achieved the highest accuracy and AUC, making it the most reliable model for detecting fake reviews.

Understanding Evaluation Metrics:

- F1-Score:**

The F1-score is the harmonic mean of precision and recall, providing a balanced measure of a model's accuracy. It is particularly useful when dealing with imbalanced datasets, like fake review detection, as it balances false positives and false negatives.

- Precision:**

Precision measures the proportion of correctly predicted positive instances (fake reviews) among all predicted positives. A high precision indicates that when the model predicts a fake review, it's likely to be correct, minimizing false positives.

- Recall:**

Recall, or sensitivity, measures the proportion of correctly predicted positives (fake reviews) among all actual positives. High recall indicates that the model can identify most of the fake reviews, minimizing false negatives.

- Accuracy:**

Accuracy calculates the overall percentage of correct predictions (both fake and real reviews). While useful, it may be misleading in imbalanced datasets as it doesn't account for the distribution of the classes.

- ROC AUC (Area Under the Curve):**

ROC AUC measures the model's ability to distinguish between classes (fake and real reviews) across all possible thresholds. A higher AUC indicates better overall performance, as it shows the model's ability to rank positives higher than negatives.

Based on the comprehensive evaluation of all models, RoBERTa was selected as the final and most effective model for the task of fake review detection. It consistently outperformed all other candidates across every key metric, including Accuracy, F1-score, and ROC AUC, demonstrating both high precision in identifying fake reviews and strong recall in capturing subtle deceptive patterns.

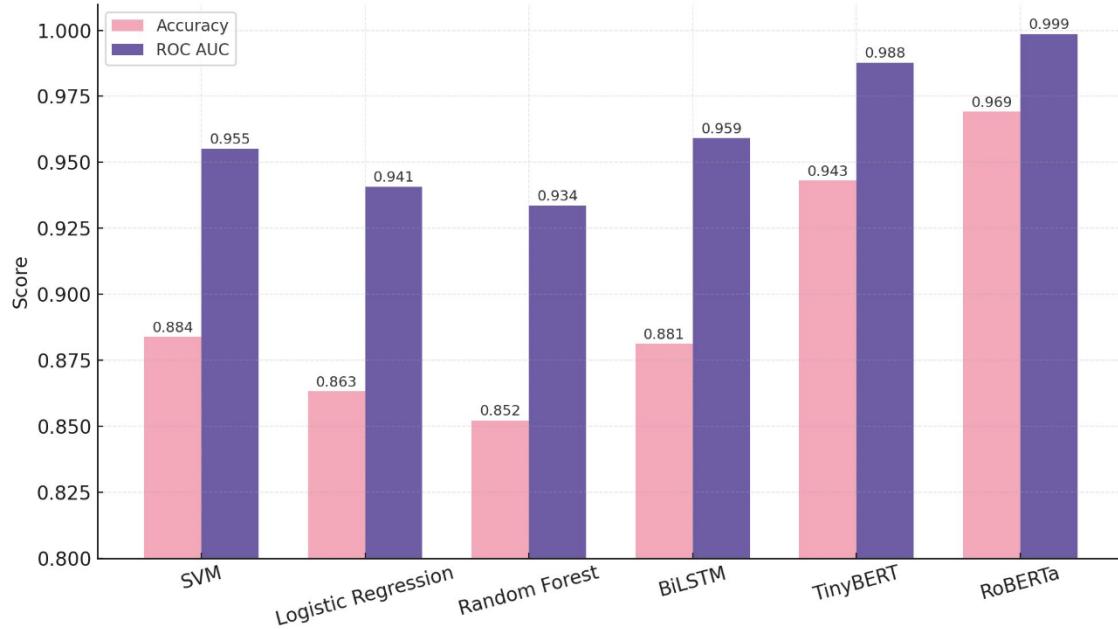


Figure 5.2: Model Comparison – Accuracy (pink) and ROC AUC (purple) for each model.

RoBERTa achieved the best balance between detecting fake content and minimizing false positives, making it the most accurate and reliable choice for real-world. In contrast, classical models such as Logistic Regression and even neural architectures like BiLSTM lack the capacity to fully model contextual dependencies and often rely on surface-level patterns. This limits their ability to generalize across varied and realistic review texts.

Table 5.7 : Detailed performance metrics (precision, recall, F1-score, etc.)

Model	Accuracy	Precision	Recall	F1 Score	ROC AUC
BiLSTM	0.881291	0.927363	0.827356	0.87451	0.959159
SVM	0.883867	0.872988	0.89916	0.885881	0.95516
Logistic Regression	0.863145	0.854171	0.876675	0.865277	0.940771
Random Forest	0.852215	0.887834	0.807177	0.845586	0.933594
TinyBERT	0.943119	0.931167	0.956963	0.943889	0.987768
RoBERTa	0.96921	0.9953	0.942864	0.968373	0.998684

5.6 Model Training Process

The training process for fake review detection was conducted using the RoBERTa-base model from the Hugging Face Transformers library. The dataset, containing 40,432 labeled reviews (balanced between fake and real), was preprocessed and split into training and testing sets using an 80/20 ratio with stratified sampling. Each review was tokenized using `RobertaTokenizer`, and attention masks were generated to ensure consistent input lengths.

A custom PyTorch `Dataset` class was implemented to convert the reviews into tokenized inputs and attention masks. These were formatted as PyTorch tensors and fed directly to the model. The model was trained using the AdamW optimizer over 3 epochs with a batch size of 16, and the loss was minimized using cross-entropy.

Full fine-tuning was performed, meaning all layers of RoBERTa were updated during training, allowing the model to adapt its internal representations specifically to the fake review detection task. Evaluation was conducted using precision, recall, F1-score, and AUC metrics, and the results demonstrated the model's strong contextual understanding and reliability.

Chapter 6 : Conclusion and Future Work

6.1 Overview

This final chapter recaps the *BuyWise* project by summarizing its goals, key achievements, main contributions, encountered limitations, and future prospects. It reflects on the development lifecycle and evaluates the effectiveness of the implemented features. The chapter concludes by outlining areas for further enhancement that can expand the platform's capabilities and real-world impact.

6.2 Summary of the Project

BuyWise is an innovative, bilingual web-based platform designed to centralize product reviews and promote transparency in consumer decision-making, with a special emphasis on locally manufactured goods. The platform empowers both users and companies to engage in open, trustworthy interactions by submitting reviews, ratings, and community comments.

The primary goal was to create a secure, user-friendly environment that supports authentic feedback and reduces misinformation through AI-driven fake review detection. Key features include multilingual support, profile management, interactive review systems, gamified engagement, and administrator moderation tools.

The platform was developed using an Agile Scrum methodology, involving requirement gathering, modular design, iterative sprint-based development, and continuous testing. By the end of the development cycle, *BuyWise* delivered a fully functional prototype that fulfills the project's initial objectives and supports future growth.

6.3 Achieved Objectives

- **Secure Authentication and Account Management:** Complete user, company, and admin authentication with email verification, profile updates, and account control.
- **Product Listing and Search:** Users and companies can add products with images and select a category. Products are searchable and filterable by name or type.
- **Review and Interaction System:** Enables reviews with star and sub-ratings, nested comments, likes, and content reporting tools.
- **Gamified Reward System:** Introduced points, levels, and badges to encourage genuine reviews, with the ability to claim company-sponsored rewards.

- **AI-Based Fake Review Detection:** A RoBERTa model analyzes submitted reviews in real-time, flagging suspicious content and displaying authenticity badges.
- **Admin Dashboard and Moderation:** Administrators can manage users, companies, categories, reviews, and flagged content via a centralized interface.
- **Company Features:** Companies can handle product submissions, view user reviews, and configure vouchers and rewards to incentivize engagement.

6.4 Main Contributions of the Work

- **Multilingual Platform with RTL Support:** Bridged the gap in Arabic-language review systems by offering full localization with RTL compatibility.
- **Automated Review Validation:** used a fine-tuned RoBERTa model to detect fake or AI-generated reviews, advancing content trustworthiness.
- **Gamified Contribution System:** Designed an interactive points-and-badges system that rewards users for authentic engagement, encouraging high-quality reviews and ongoing participation.
- **Tangible Incentives via Reward Claims:** Linked verified user contributions to real-world value by enabling users to claim company-sponsored rewards securely through integrated voucher systems.
- **Dynamic Community Engagement:** Introduced advanced commenting features, reactions, and notifications to foster active, authentic community involvement.
- **Comprehensive Admin Control Panel:** The admin is given full access to a centralized dashboard for managing users, companies, products, comments, categories, and flagged content, along with access to platform analytics, ensuring complete control over activity, content moderation, and performance insights.

6.5 Limitations

Despite the successful implementation of many core features, the *BuyWise* platform faced several limitations due to time, data availability, and technical constraints:

- **Lack of Suitable Arabic Dataset:** The unavailability of a large, high-quality Arabic-language product review dataset delayed the development of an Arabic-specific AI model. As a result, fake review detection currently relies on non-Arabic data, which may not fully represent regional linguistic tones.
- **Dependence on User-Provided Local Product Claims:** The system cannot verify whether a product is truly locally manufactured without official data. Integration with external verification bodies such as the Chamber of Commerce was beyond the project's scope, introducing a potential for misinformation regarding product origin.
- **No Real-Time Communication:** Users cannot chat or communicate directly through the platform. This limits community collaboration and prevents real-time seller-buyer discussions, which are often useful in review platforms.
- **No Integrated E-Commerce or Payment Gateways:** *BuyWise* serves solely as a review and rating platform. It does not facilitate product purchases or financial transactions, as there is no integration with services like PayPal, Stripe, or marketplace APIs such as Amazon.
- **Web-Only Accessibility:** The platform is currently limited to web browsers. The lack of a dedicated mobile application may restrict access for users who prefer smartphone-based experiences, reducing potential engagement and convenience.
- **Unimplemented AI for Fake Product Detection:** Although initially planned, an AI model to detect counterfeit or non-original products was not implemented. This was due to limited time and complexity. Product authenticity currently relies on manual verification by the administration.

6.6 Future Work

To address the current limitations and elevate *BuyWise*'s functionality and value, several future development opportunities are proposed:

- **Arabic AI Model for Review Validation:** Training a dedicated fake review detection model on authentic Arabic review data will significantly improve moderation accuracy for the regional user base. This also supports inclusivity and language relevance.
- **Local Product Verification System:** Collaborating with regulatory or governmental bodies, such as the Chamber of Commerce, could enable product verification through official databases. Verified products could then receive certification badges, thereby increasing user trust.
- **Real-Time Messaging Integration:** Adding user-to-user messaging or chat would enable faster interactions, enhance trust, and allow direct discussions about products or reviews. This could also support private conversations between companies and reviewers.
- **Third-Party Marketplace and Payment Integration:** Incorporating secure payment gateways and APIs from platforms like Amazon or eBay would allow *BuyWise* to evolve from a review tool to a transaction-enabled platform, supporting direct purchases and order tracking.
- **Mobile Application Development:** Creating native or hybrid apps for Android and iOS would greatly improve usability and accessibility. Features such as push notifications, offline browsing, and mobile camera integration for QR or barcode scanning could be introduced.
- **Subscription-Based Model for Advanced Features:** A monthly subscription plan could be introduced to provide users and companies with premium services such as unlimited reviews, and enhanced AI detection capabilities

6.7 Conclusion

The *BuyWise* platform successfully delivers a robust, user-focused web application aimed at enhancing trust in online product reviews. With bilingual support, interactive features, gamification elements, and AI-driven fake review detection, the system establishes a solid foundation for ethical, community-driven feedback.

Although some limitations remain particularly regarding Arabic data support, mobile access, and the lack of official integration for verifying local product authenticity, the core infrastructure and objectives were achieved. The project provides meaningful contributions to the domain of trustworthy online reviews, especially in underserved bilingual and local product markets.

Future enhancements, including mobile apps, marketplace integration, localized AI models, and partnerships with official entities, present a clear and promising roadmap for transforming *BuyWise* into a leading platform for credible, user-driven product evaluation.

References:

- [1] Circuit, “Amazon Fake Review Analysis: 33.5M Reviews Examined,” *Circuit Blog*. [Online]. Available: <https://getcircuit.com/route-planner/blog/amazon-fake-review-analysis> (accessed June 16, 2025).
- [2] Bazaarvoice, “Study reveals consumers’ concern about fake reviews.” [Online]. Available: <https://www.bazaarvoice.com/press/bazaarvoice-study-reveals-consumers-concern-about-fake-reviews-63-think-brands-should-be-solving-the-issue/> (accessed March 21, 2025).
- [3] Cybernews, “Millions of Amazon reviews fake, study finds.” [Online]. Available: <https://cybernews.com/security/millions-amazon-reviews-fake/> (accessed March 21, 2025).
- [4] Namecheap, “The problem with computer-generated reviews in e-commerce.” [Online]. Available: <https://www.namecheap.com/blog/the-problem-with-ai-generated-reviews-in-e-commerce/> (accessed March 22, 2025).
- [5] K. Schwaber and J. Sutherland, “The Scrum Guide (latest official version),” *Scrum.org*, Nov. 2020. [Online]. Available: <https://scrumguides.org/scrum-guide.html> (accessed June 16, 2025).
- [6] Yelp, “End of Year Product Release 2024,” *Yelp Blog*. [Online]. Available: <https://blog.yelp.com/news/end-of-year-product-release-2024/> (accessed June 16, 2025).
- [7] Goodreads, “Community Guidelines,” *Goodreads.com*. [Online]. Available: <https://www.goodreads.com/help/show/53-community-guidelines> (accessed June 16, 2025).

- [8] TripAdvisor, “2023 Review Transparency Report,” *TripAdvisor*. [Online]. Available: <https://www.tripadvisor.com/TransparencyReport2023> (accessed June 16, 2025).
- [9] J. Vincent, “CNET pushed reporters to be more favorable to advertisers, staff say,” *The Verge*, Feb. 2, 2023. [Online]. Available: <https://www.theverge.com/2023/2/2/23582046/cnet-red-ventures-ai-seo-advertisers-changed-reviews-editorial-independence-affiliate-marketing> (accessed June 16, 2025).
- [10] Metacritic, "About Metacritic," *Metacritic*. [Online]. Available: <https://www.metacritic.com/about-metascores> (accessed June 16, 2025).
- [11] GameSpot, "FTC bans fake reviews," *GameSpot*. [Online]. Available: <https://www.gamespot.com/articles/ftc-bans-fake-reviews/1100-6512841/> (accessed April 20, 2025).
- [12] PCMag, "About PCMag – independent, labs-based reviews of tech products and services," *Ziff Davis*. [Online]. Available: <https://www.ziffdavis.com/brands/technology/pcmag> (accessed June 16, 2025).
- [13] Trustpilot, *Trustpilot Trust Report 2025: Growing use of AI helps protect the platform*, press.trustpilot.com, May 29, 2025. [Online]. Available: <https://press.trustpilot.com> (accessed June 16, 2025).
- [14] Which?, “What we do,” *Which?*. [Online]. Available: <https://www.which.co.uk/about-which> (accessed June 16, 2025).
- [15] G2, “How does G2 ensure authenticity in published reviews?” *G2 Help Center*, Oct. 28, 2021. [Online]. Available: <https://help.g2.com/hc/en-us/articles/360033182931> (accessed June 16, 2025).

- [16] R. Pichler, *The Product Owner: Leveraging Scrum to Deliver Customer Value*, 2nd ed. Boston, MA, USA: Addison-Wesley, 2022. Available: <https://www.informit.com/store/product-owner-leveraging-scrum-to-deliver-customer-value-9780134686097> (accessed June 16, 2025).
- [17] Function Points, “Function Point Analysis,” FunctionPoints.org. Available: <https://www.functionpoints.org/function-point-analysis.html> (accessed June 17, 2025).
- [18] International Function Point Users Group (IFPUG), *Function Point Counting Practices Manual*, Release 4.3.1. IFPUG, 2010. Available: <https://www.ifpug.org/functional-size-measurement/standards/> (accessed June 16, 2025).
- [19] Hugging Face, “RoBERTa Model Documentation.” Available: https://huggingface.co/docs/transformers/en/model_doc/roberta (accessed June 16, 2025).
- [20] Kaggle, “Fake Reviews Dataset.” Available: <https://www.kaggle.com/datasets/mexwell/fake-reviews-dataset> (accessed June 16, 2025).

Appendix:

A. RoBERTa

Overview

RoBERTa (short for "*Robustly Optimized BERT Approach*") is a variant of the BERT (*Bidirectional Encoder Representations from Transformers*). RoBERTa is type of artificial intelligence technology that is used for natural language processing. RoBERTa enhances model performance through optimized training techniques and larger data exposure. It is particularly effective in understanding the context and semantics of human language.

RoBERTa utilizes self-attention mechanisms and deep encoder layers to generate contextualized word representations, making it highly capable of analyzing large volumes of unstructured text, such as user-generated reviews.

How RoBERTa Works

1. Tokenization

- The input sentence is first broken down into sub-word units (tokens) using Byte Pair Encoding (BPE).
- This helps break unknown or rare words into familiar parts.

Example: “unhappiness” → “un” + “happi” + “ness”

2. Embedding

- Each token is turned into a vector of numbers (typically of size 768 for roberta-base).
- These vectors represent the meaning and position of each token within the sequence.

3. Encoder Stack (12 Layers in roberta-base)

RoBERTa has 12 encoder layers, and each one does the following steps to understand how words relate to each other in context:

a. Multi-Head Self-Attention

- The model looks at the full sentence and compares each word with every other word.
- Multiple attention “heads” allow the model to learn various types of relationships (semantic, syntactic, positional).
- Example: In “The cat sat on the mat,” the word “cat” may strongly attend to “sat.”

- All these heads are then combined into one attention output.

b. Add & Layer Normalization

- The attention output is added to the original input (residual connection) to keep information flowing.
- Layer normalization stabilizes the learning process by standardizing the output(ensuring that the activations have a mean of 0 and a standard deviation of 1)
- After layer normalization, scaling and shifting allow the model to adjust the normalized values by applying learnable parameters to control their range and mean, helping the model adapt better to the data.

c. Feed-Forward Network (FFN)

- Each token's vector is passed through a two-layer neural network:
 - Expands to size 3072, applies a non-linear activation (GeLU),
 - Then reduces back to 768 dimensions.
- This gives the model a deeper understanding of each token.

d. Add & Layer Normalization (again)

- The output of the FFN is added to the previous result, and normalized again.
- After this process, each token has a new vector that includes not just its meaning, but how it relates to other words in the sentence.
- This updated vector becomes the input for the next encoder layer.
- After 12 layers, each token has a deep, contextual understanding.

4. Classification Using <s> Token

- A special <s> token is added to the beginning of the input.
- After all layers, the vector of <s> holds the full sentence meaning.
- This vector is passed to a classification head (typically a dense layer) to produce output predictions (e.g., "Fake" or "Real").

5. Loss Calculation

- The model's prediction is compared with the correct answer.
- Cross-Entropy Loss is used to measure the error.

6. Backpropagation

- Gradients are calculated by moving backward through the model to understand which weights contributed to the error.

7. Weight Updates

- Using Gradient Descent, the model updates its weights.
- These updates are applied after each batch of training data to improve the model iteratively.

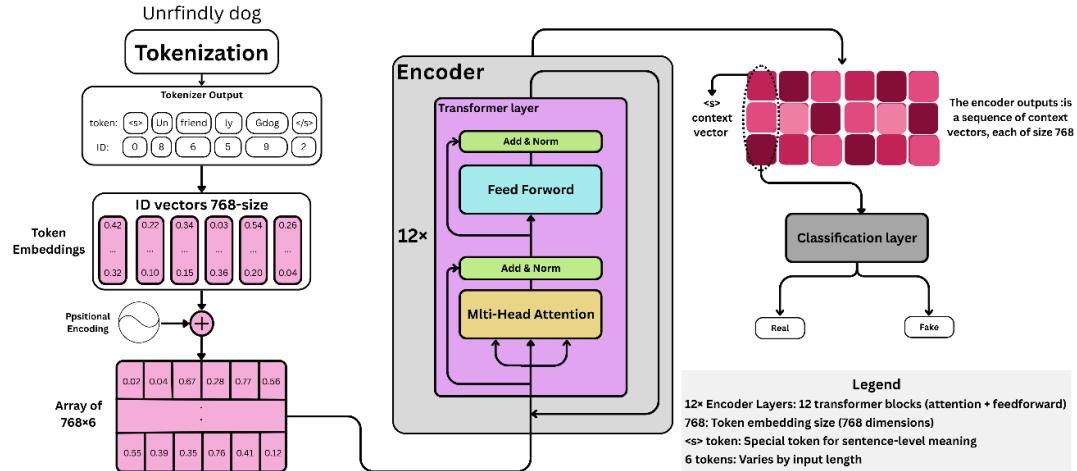


Figure A.1: RoBERTa Architecture

Dataset Class Distribution

We loaded the dataset and examined its structure and class balance. The dataset is perfectly balanced, containing 20,216 real (OR) reviews and 20,216 fake (CG) reviews. The bar chart above confirms this 50/50 class distribution, which is ideal for training a classification model – there is no class imbalance to bias the model toward predicting the majority class. Each review also includes a star rating (1–5), but this feature was considered auxiliary and not used directly in model training for fake review detection.

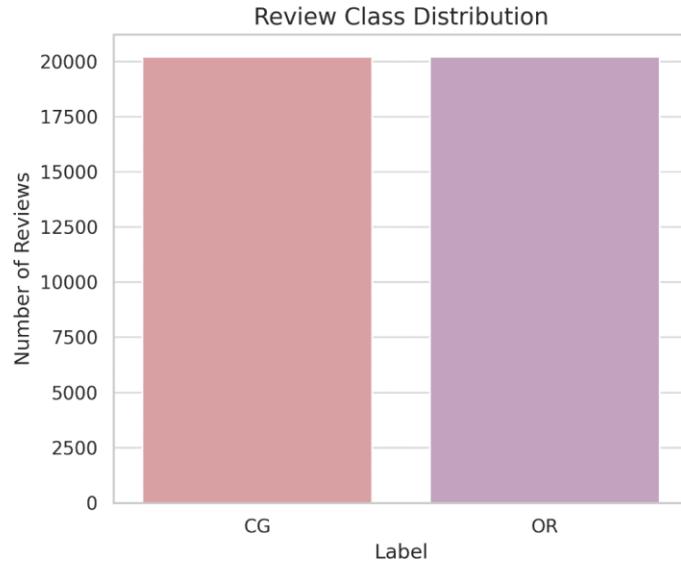


Figure A.2: Class distribution of real (OR) vs fake (CG) reviews in the dataset.

Data Quality Analysis

We also checked for common NLP dataset issues and found that this dataset is overall clean and well-structured:

1. Imbalance Class:

Not an issue. As noted, the classes are evenly distributed (50% real, 50% fake), so the model can learn to detect fakes without bias.

2. Text Quality (Noise / Length):

The dataset contains well-written, natural-language reviews. Most entries are a few sentences long, providing enough context for modeling. There was no evidence of spam, gibberish, or overly short reviews.

3. Duplication or Irrelevant Features:

No duplicates or irrelevant attributes were found. Each entry includes clean, relevant fields: category, rating, text, and label.

Evaluation Based on F1-Score and Related Metrics

The F1-score, which balances precision and recall, provides a comprehensive measure of a model's performance—especially in binary classification tasks like fake review detection. The results reinforce the superiority of transformer-based models. RoBERTa achieved the highest F1-score (~0.968), followed closely by TinyBERT (~0.944).

In contrast, classical machine learning models and the BiLSTM network recorded noticeably lower F1-scores, generally ranging between 0.85 and 0.89. Specifically:

- Random Forest recorded the lowest F1-score at approximately 0.846.
- Logistic Regression scored around 0.865.
- BiLSTM achieved an F1 of ~0.875.
- SVM performed slightly better with an F1 of ~0.886.

These scores align with the precision and recall values observed for each model. RoBERTa stood out not only for its high recall (indicating strong ability to detect fake reviews) but also for its exceptionally high precision (~0.995), meaning it rarely mislabeled real reviews as fake.

TinyBERT also showed strong performance across both metrics, with precision and recall values ranging between 0.93 and 0.96.

In contrast, simpler models exhibited more significant trade-offs. For example, Logistic Regression showed relatively good recall (~0.877) but lower precision (~0.854), indicating a tendency to detect fakes at the expense of more false positives.

In summary, RoBERTa outperformed all other models across every evaluation metric—Accuracy, F1-score, and ROC AUC—making it the most reliable option. TinyBERT emerged as a strong second choice. Meanwhile, SVM and BiLSTM provided moderate results, and the traditional models (Logistic Regression and Random Forest) lagged behind in both consistency and overall performance.

Confusion Matrix Analysis and Final Model Comparison

Traditional models such as Logistic Regression and SVM achieved moderate performance, with SVM slightly outperforming Logistic Regression. However, both models struggled with false positives and false negatives. Random Forest had the weakest results, generating numerous false positives by incorrectly labeling genuine reviews as fake.

The BiLSTM model performed better than the traditional approaches, particularly in identifying fake reviews, yet still produced a considerable number of false positives. In contrast, TinyBERT demonstrated a significant reduction in misclassifications and maintained a strong balance between precision and recall.

At the top of the comparison, RoBERTa delivered near-perfect results, minimizing both false positives and false negatives. Its confusion matrix showed very few misclassifications, highlighting its superior ability to distinguish between real and fake reviews.

Sample Misclassifications by the Model

A **false positive** occurs when the model incorrectly classifies a fake review as real, while a **false negative** refers to a real review being wrongly predicted as fake. The images below show sample reviews that were misclassified by the model. These examples help highlight the kinds of reviews that can confuse the model and lead to incorrect predictions.

TrueLabel	Predicted	text
0	1	Exactly as I wanted! Can't say enough good things about this tool.
0	1	First time I bowled in a sporting event with my Dad I saw him wearing a dress and he was so impressed.
0	1	GREAT STORY,,,GOOD READING, COULDN'T PUT THE BOOK DOWN!!
0	1	This bottle is amazing! It's a little large for my size 11 but fits my hand well!\n
0	1	Diferente por su argumento que esta su su reo de la historia de la personaje su esta su pregunta
0	1	Appears well made (in comm't that it's an inch longer than a standard toilet seat)
0	1	Beautiful rug. I've had it for 3 years and love it.
0	1	Love it. Can easily be worn as a nightgown.
1	0	These were great. I just had to order a longer size.
1	0	This ball is super solid and secure in the hand. The grip is good and tight because of the soft, yet durable, outer material. The ball is solid construction and works absolutely great.
1	0	This monitor is gigantic, and a pretty good value. I have really enjoyed using it, enough that I am thinking of buying one and carrying it to work. I don't know if it really is better on the eyes, but it's beautiful.
1	0	These are very easy to use, easy to clean, and being able to freeze and microwave is a great boon
1	0	as others mentioned - cord kinda small, and the hose is kinda stiff.
1	0	This works just as well as my old Kitchen-aid mixer did and it's not as cumbersome. My only suggestion to the manufacturer is it needs a bowl with a handle.
1	0	I've been using these for a few weeks now and I have had no problems. The build quality is very good on these.
1	0	They look comfortable and well-made but I found that they were too narrow in the toe area.
1	0	Came as described and fast shipping. My dog absolutely loves this toy and it has lasted for a long time

Figure A.3: Misclassified reviews: false positives and false negatives.

B. User Acceptance Testing Result:

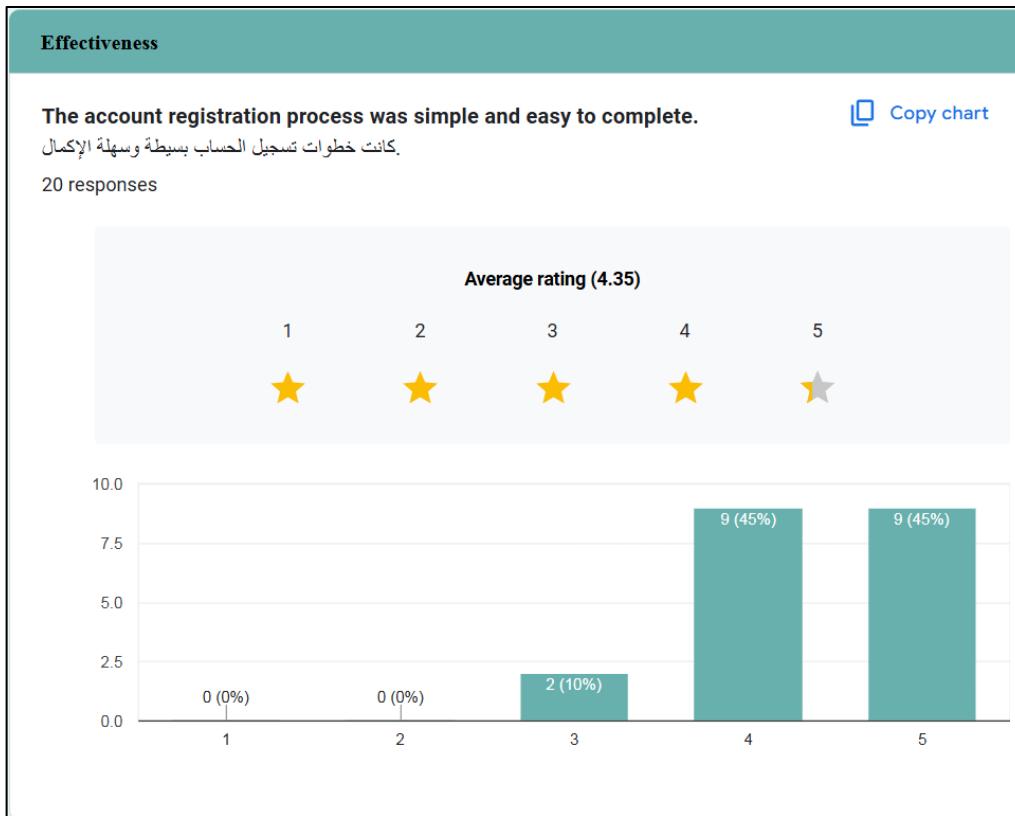


Figure B.1: UAT - Account Registration screen.

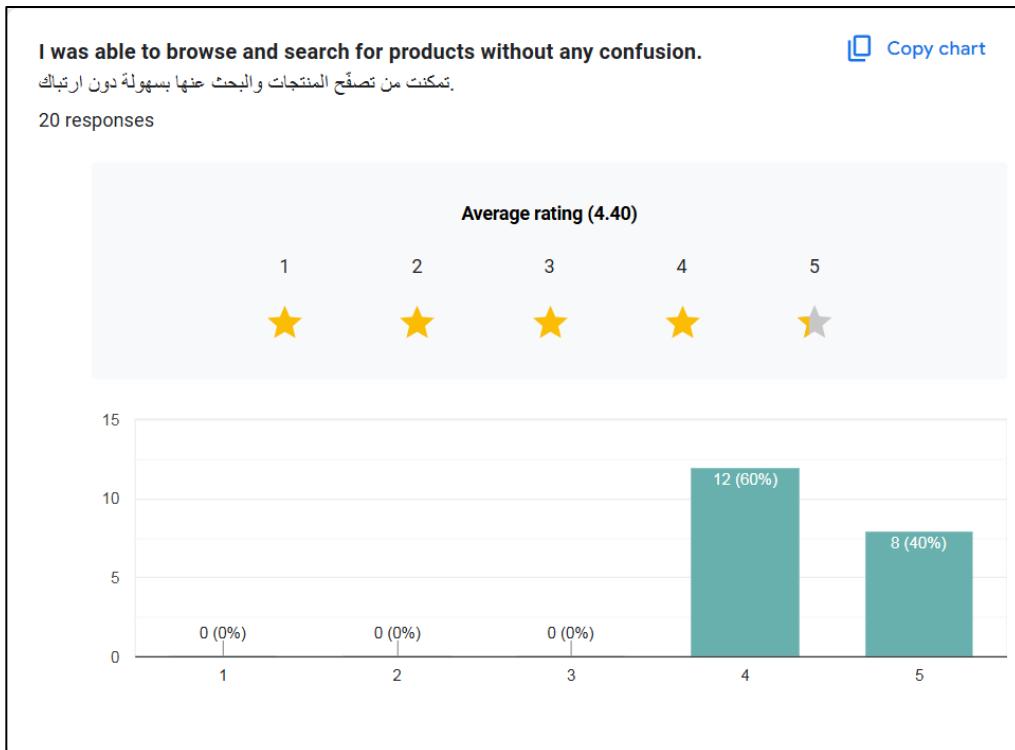


Figure B.2: UAT - Product Browsing interface.

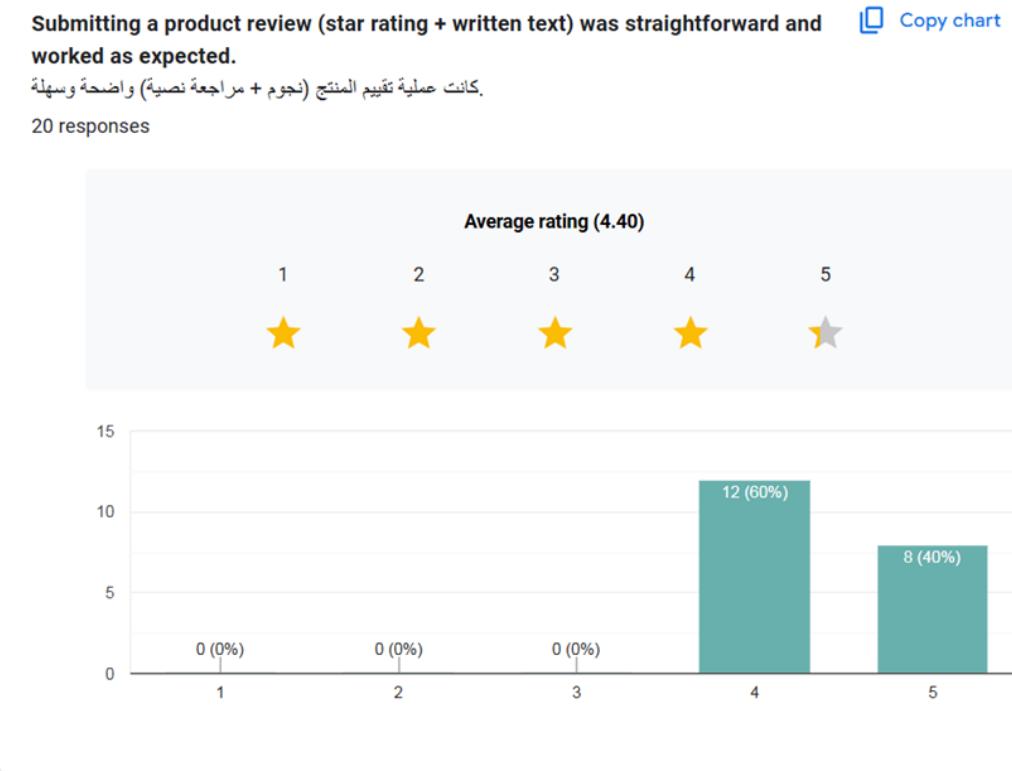


Figure B.3: UAT - Review Submission form.

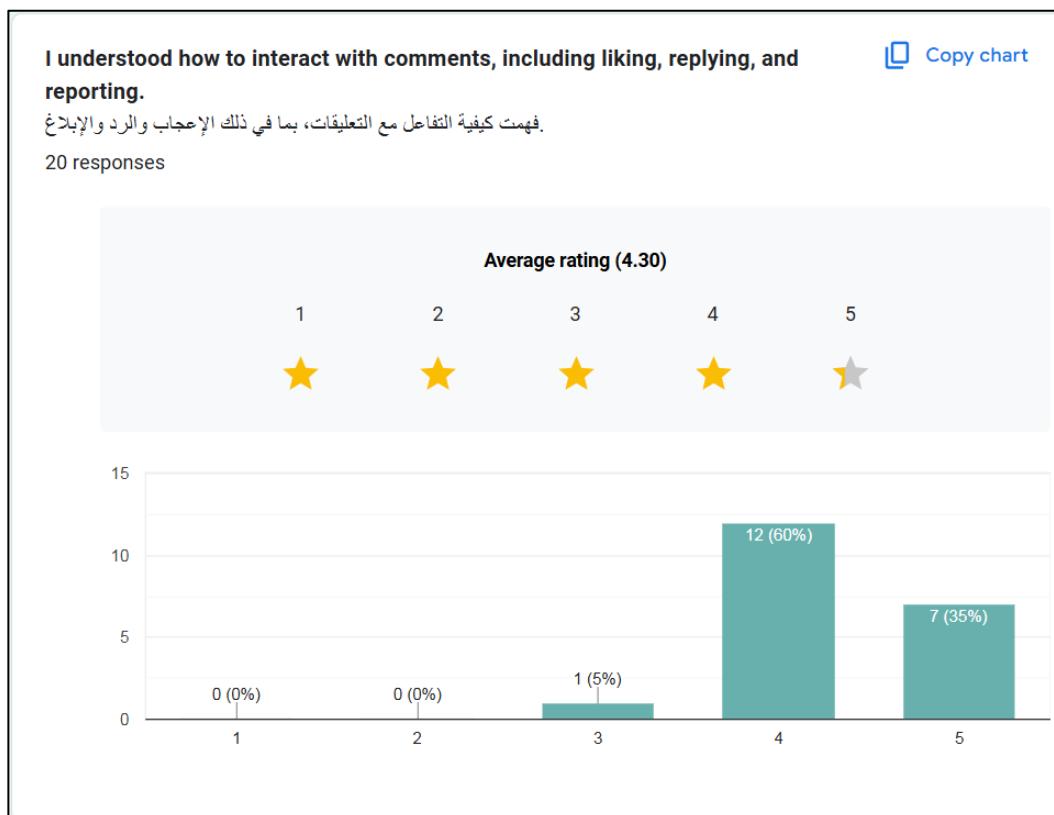


Figure B.4: UAT - Commenting Features panel.

The reward system was clear in terms of earning and redeeming points.

كان نظام المكافآت واضحًا من حيث كسب واسترداد النقاط.

20 responses

[Copy chart](#)

Average rating (4.05)

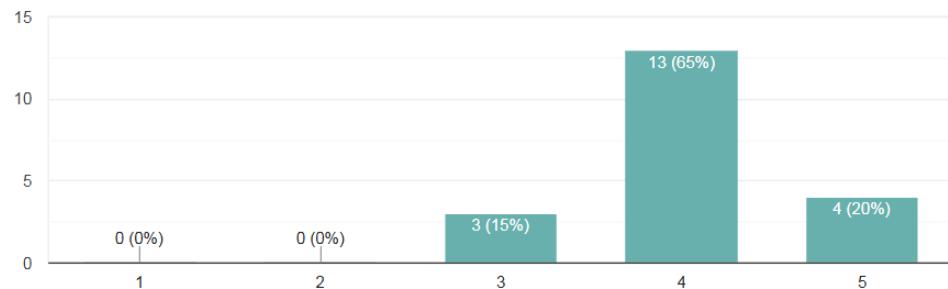


Figure B.5: UAT - Reward System clarity display.

I would consider using the platform again and recommending it to others.

سأستخدم هذه المنصة مرة أخرى وسأوصي بها لآخرين.

20 responses

[Copy chart](#)

Average rating (4.45)

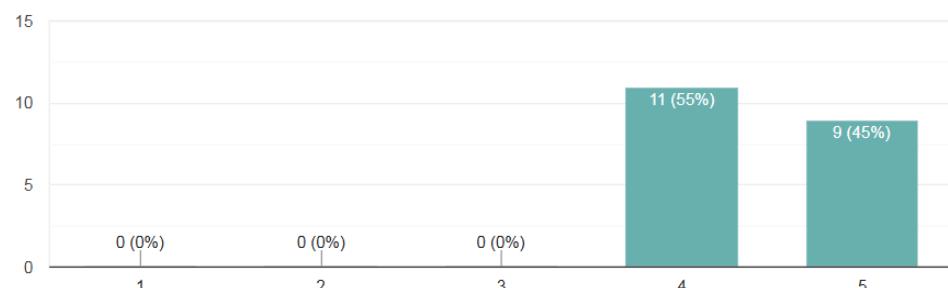


Figure B.6: UAT - Reuse & Recommendation section.

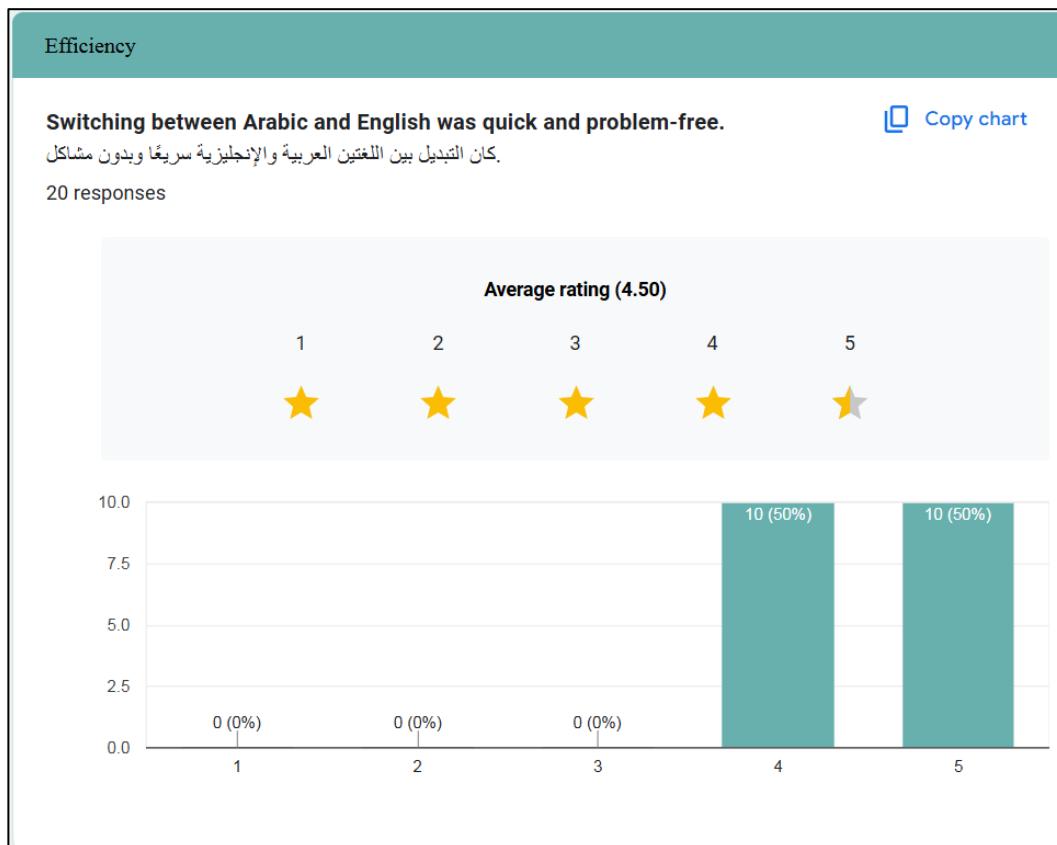


Figure B.7: UAT - Language Switching toggle.

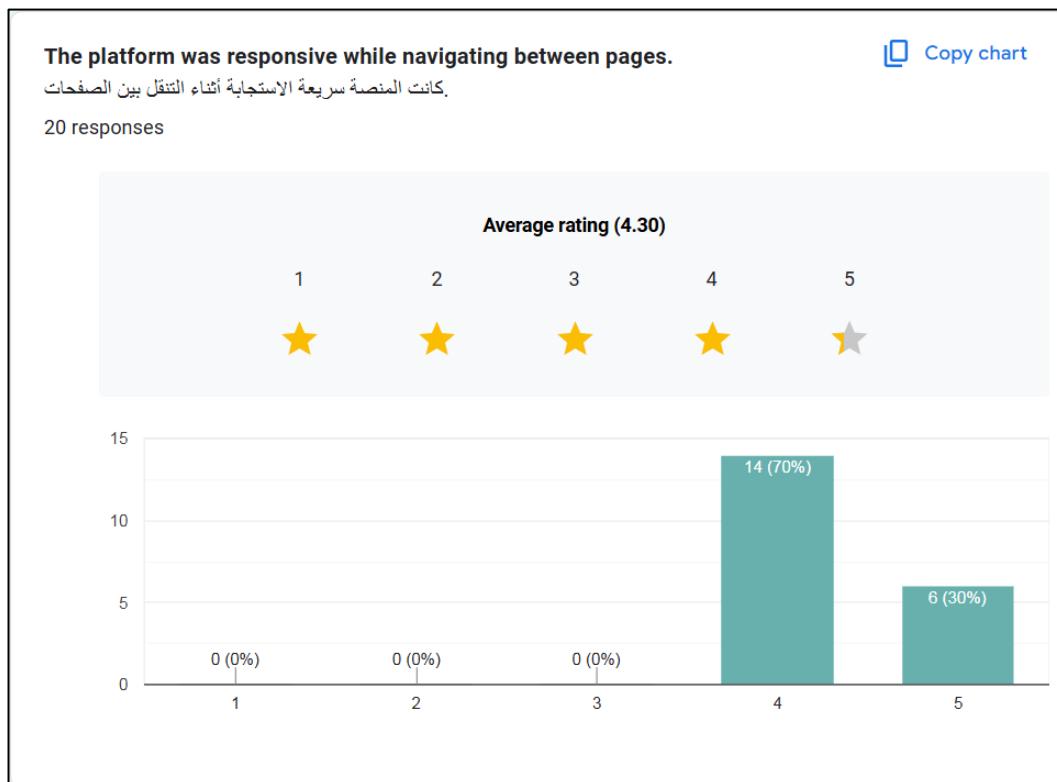


Figure B.8: UAT - Platform Responsiveness test.

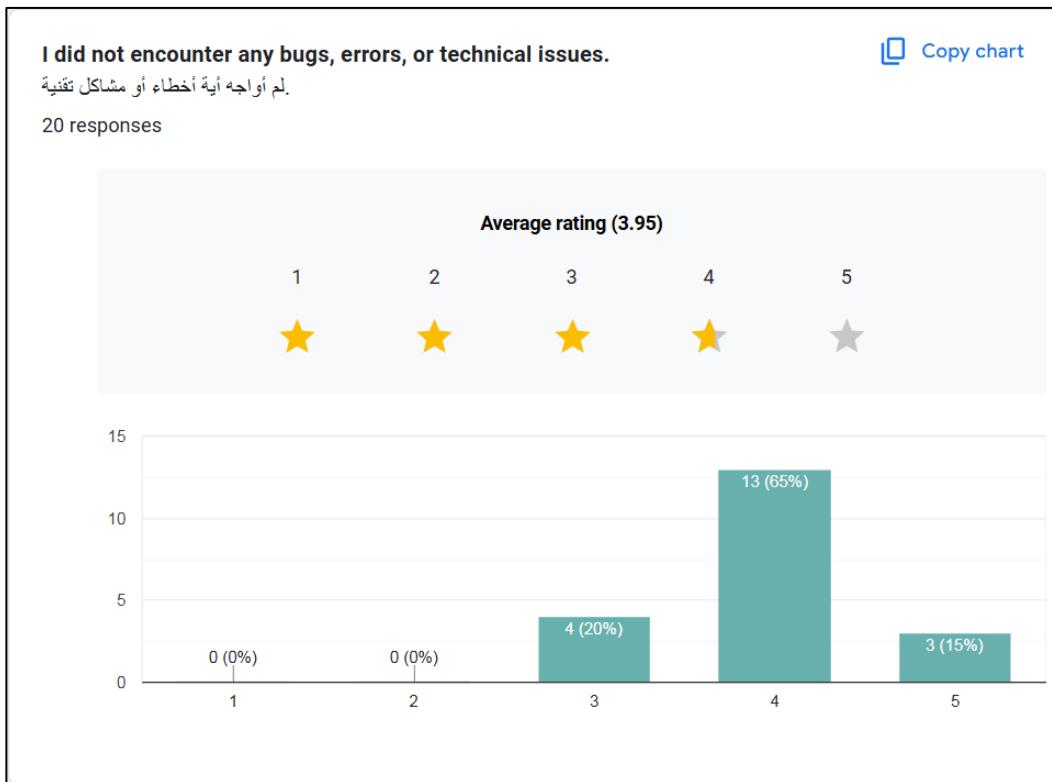


Figure B.9: UAT - Error handling demonstration.

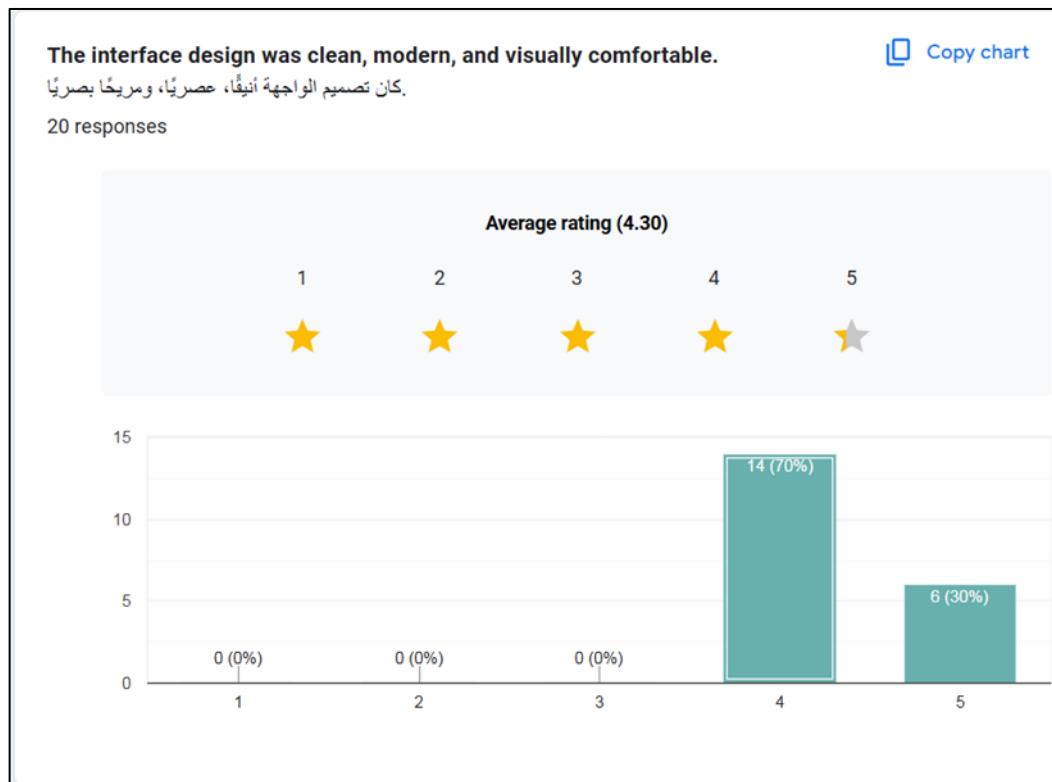


Figure B.10: UAT - Visual Design and comfort.

Overall, the platform was easy to use and navigate.

بشكل عام، كانت المنصة سهلة الاستخدام والتنقل.

20 responses

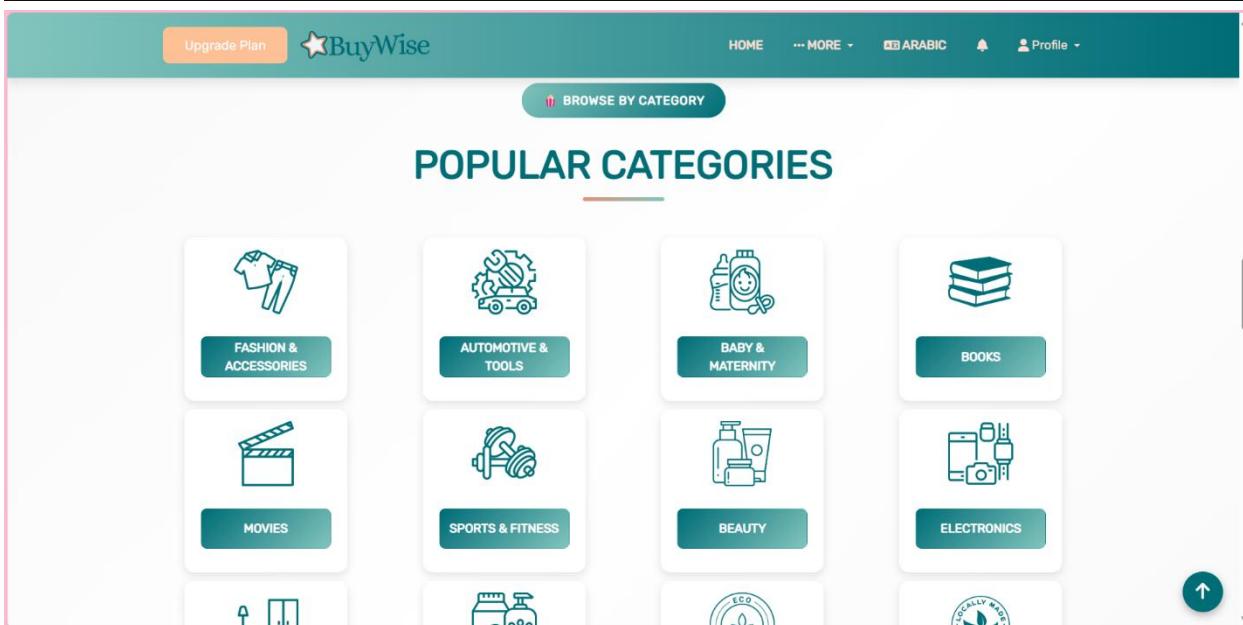
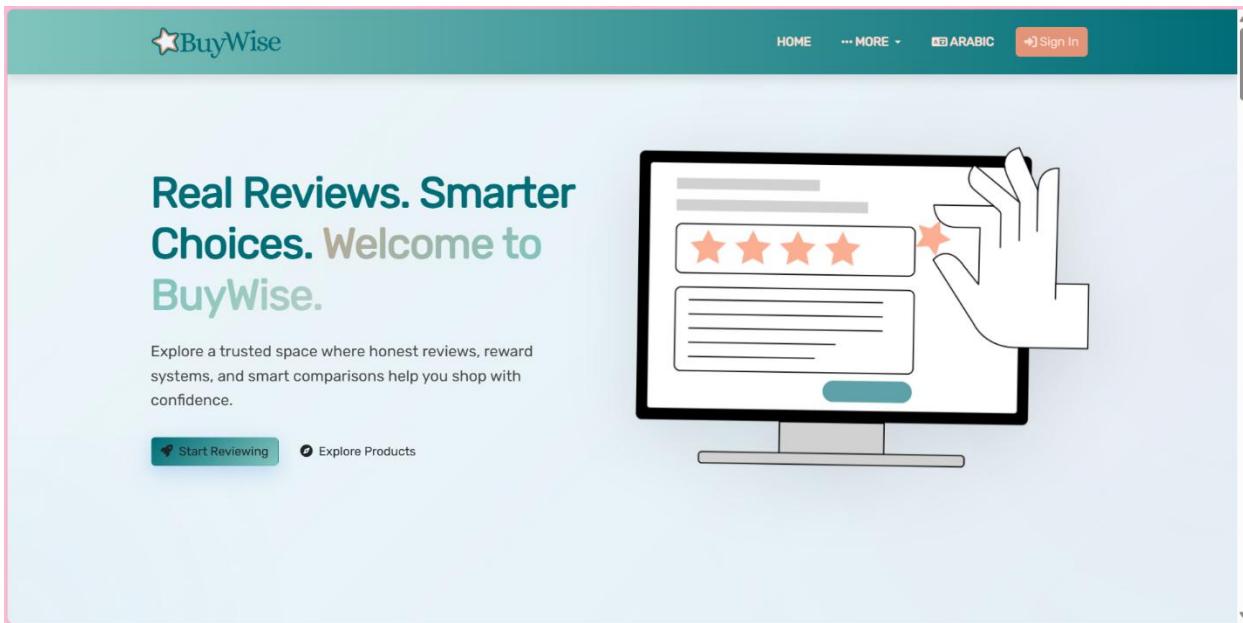
 Copy chart



Figure B.11: UAT - Overall Platform Usability overview.

C. Interfaces Screenshots

C.1 User





Upgrade Plan

HOME ... MORE ARABIC Profile

PREMIUM PARTNERS

TRUSTED BRANDS



ChicCharm

VERIFIED



GlamShine

VERIFIED

The screenshot shows a 'POINTS SYSTEM' section with a title 'HOW DO YOU EARN POINTS?' and a sub-section explaining point earnings for reviews, comments, and likes. It includes a table mapping actions to point values for regular and local Jordanian products, and a 'Badges Based on Points' section with four levels: Normal, Professional, Expert, and Legend.

Action	Regular Product	Local Jordanian Product
Submit a Product Review	+10	+20
Post a Comment	+3	+6
Receive a Like	+2	+4

Badges Based on Points

- Normal**
0 to 499 points
- Professional**
500 to 1499 points
- Expert**
1500 to 4999 points
- Legend**
5000+ points

Welcome Back!

To keep connected with us, please login with your info

[SIGN IN](#)

Create Account

Username

Email

Password

Confirm Password

Gender

Phone

[SIGN UP](#)[Register as Company](#)[Upgrade Plan](#)

Raghad

✉ raghadt730@gmail.com

35

Products

2

Comments

Professional
264 pts[Products](#)[Comments](#)[My Vouchers](#)[Account Settings](#)

Your Comments



mug

May 30, 2025

.....

[View on Product](#)[Delete](#)

mug

May 30, 2025

[Upgrade Plan](#)

Raghad

✉ raghadt730@gmail.com

35

Products

2

Comments

Professional
264 pts[Products](#)[Comments](#)[My Vouchers](#)[Account Settings](#)

Your Comments



mug

May 30, 2025

.....

[View on Product](#)[Delete](#)

mug

May 30, 2025

Upgrade Plan



HOME ... MORE ARABIC Profile


Raghad
raghadt730@gmail.com

35 Products
2 Comments

Products Comments My Vouchers Account Settings

My Vouchers

BUY50	Active	BUY25	Active
Discount: 50.00% Min Points: 100 Expiry Date: 2025-12-31 Company: ChicCharm <small>Assigned At: 2025-06-03 02:55</small>		Discount: 25.00% Min Points: 100 Expiry Date: 2025-12-31 Company: ChicCharm <small>Assigned At: 2025-06-03 02:54</small>	

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Upgrade Plan



HOME ... MORE ARABIC Profile

Manage Account

Name	Email
raghad	raghadt730@gmail.com
Birth Date	Gender
2003-01-31	Female
Address	
Amman	
Phone	
0780369326	
Bio	
Sweet Nothing	

Changing your password will require you to log in again.

Upgrade Plan



HOME ... MORE ARABIC Profile

Product Name

Product Description

Product Category

Product Rating


Main Product Image *

No file chosen

Additional Images (Up to 2)

No files chosen

ADD PRODUCT

[Upgrade Plan](#)[HOME](#)[... MORE](#)[ARABIC](#)[Profile](#)

Add Your Review

Your Rating:



Quality

[-- Select --](#)

Write your review here...

Upload an image (optional)

[Choose an image](#)[Add Review](#)[Upgrade Plan](#)[HOME](#)[... MORE](#)[ARABIC](#)[Profile](#)[Home / Local / mug](#)Posted by
 Raghad

Category: Local

Rating: ★★★★☆

اشتريتهم من بيت الفرج شارع القدس يجتذوا واسعارهم مناسبة

[Unverified Review](#)

Reviews (2)

5.00 ★★★★★

Quality
Very Good[Upgrade Plan](#)[HOME](#)[... MORE](#)[ARABIC](#)[Profile](#)

Customer Reviews (2)

Filter by Rating: [All](#)Sort by: [Latest](#)[Apply](#)[Reset](#)

See what other customers are saying

Raghad ★★★★★
May 30, 2025 at 11:51pm

Quality: Very Good

كثير حلووو

[Unverified](#)[0](#) [Reply](#)[▲ Hide replies](#)Raghad May 30, 2025 at 11:53 pm
لهم[0](#) [Reply](#)

Home / Popular Categories / Local

Search products... Newest All Sources Filter

Sponsored طقم اطفال بناتي (0.0) View

Sponsored هودي بيج (0.0) View

Sponsored وشاح تخرج 2024 (0.0) View

mug (0.0) View

+ Add Product

Upgrade Plan ★BuyWise

HOME ... MORE ARABIC Profile

Rewards Center

Your Points: 64

BUY50
Company Name: ChicCharm
Points Required: 100
Expiry Date: 2025-12-31
[Redeem Now](#)

BUY25
Company Name: ChicCharm
Points Required: 100
Expiry Date: 2025-12-31
[Redeem Now](#)

Upgrade Plan ★BuyWise

HOME ... MORE ARABIC Profile

Home / Frequently Asked Questions

Frequently Asked Questions

How do I register for a BuyWise account?
Click on "Sign Up", select your role (User or Company), fill in the registration form, and verify your email address using the link sent to you.

I didn't receive my email verification. What should I do?
Check your spam or junk folder. If not found, click "Resend Verification" or contact BuyWise via Email.

How can I reset my password?
Click "Forgot Password" and follow the email instructions to reset it securely.

How do I add a product as a user or company?

Upgrade Plan
BuyWise
HOME ... MORE ARABIC Profile

[Home](#) / [Policies](#)

Policies & Guidelines

[1. Privacy Policy](#)
[2. Terms of Service](#)
[3. Content & Review Policy](#)
[4. Reward & Badge Policy](#)

[5. Reporting & Moderation](#)

1. Privacy Policy

BuyWise respects your privacy. We collect only necessary information such as your name, email, and account type to offer a secure and personalized experience. Your data is stored securely and never shared without consent. Users can request to view, update, or delete their personal data at any time.

2. Terms of Service

By using BuyWise, you agree to follow our usage terms. These include respecting others, avoiding spam or abuse, and posting only relevant and authentic content. BuyWise reserves the right to suspend or delete accounts that violate these terms.

4. Reward & Badge Policy

BuyWise uses a point-based system to recognize and reward user contributions. Points are awarded for meaningful engagement such as reviewing products, commenting, and receiving likes.

How are points earned on BuyWise?

Action	Regular Product	Local Jordanian Product
Submit a Product Review	+10	+20
Post a Comment	+3	+6
Receive a Like	+2	+4

What are the badge levels and what do they mean?

As you earn points, your badge level automatically increases to reflect your contributions:

Normal – 0 to 499 points
Professional – 500 to 1499 points
Expert – 1500 to 4999 points

Legend – 5000+ points

How do company rewards work?

Companies can offer rewards (e.g., vouchers or discounts) to users who engage with their products. Eligible users can view and claim these in the "My Vouchers" tab under their dashboard. Availability and requirements may vary by company.

Points and levels Calculation:

How are points earned on BuyWise?

Action	Regular Product	Local Jordanian Product
Submit a Product Review	+10	+20
Post a Comment	+3	+6
Receive a Like	+2	+4

What are the badge levels and what do they mean?

As you earn points, your badge level automatically increases to reflect your contributions:

Normal – 0 to 499 points
Professional – 500 to 1499 points
Expert – 1500 to 4999 points

Legend – 5000+ points

76

C.2 Company:

The image displays two screenshots of the BuyWise platform interface.

Screenshot 1: Product Management

This screenshot shows the 'Your Products' section for a user named 'GlamShine'. The interface includes a header with navigation links: HOME, MORE, ARABIC, Profile, and a notification icon with 9 notifications. The user's profile picture is a circular logo for 'GlamShine' featuring a stylized 'A' and 'M'. The email address is listed as islam_rafati@hotmail.com. A total of 9 products are shown.

The products listed are:

- Lip gloss**: Price: JOD 4.00, Category: Beauty. Buttons: VIEW, DELETE.
- Lipstick**: Price: JOD 4.00, Category: Beauty. Buttons: VIEW, DELETE.
- Mascara**: Price: JOD 13.99, Category: Beauty. Buttons: VIEW, DELETE.

Screenshot 2: Add Product

This screenshot shows the 'Add Product' form. The header is identical to the first screenshot. The form fields include:

- Product Name: Input field.
- Product Description: Input field.
- Product Price (JOD): Input field.
- Category: A dropdown menu labeled "Choose a category".
- Main Image: A file input field with the placeholder "Choose Main Image".
- No file chosen: A note indicating no main image has been selected.
- Additional Images: A file input field with the placeholder "Choose Additional Images".
- No files chosen: A note indicating no additional images have been selected.
- Submit Product: A green button with a plus sign.

[Your Products](#) [Add Product](#) [Vouchers](#) [Settings](#)

Add New Voucher

Your Vouchers

#	Voucher Code	Discount Value (%)	Points Required	Expiry Date
1	Glam50	50.00	500	2025-06-14

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[Your Products](#) [Add Product](#) [Vouchers](#) [Settings](#)

Account Settings



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Rewards Center

BUY50
Company Name: ChicCharm

Points Required: 100

Expiry Date: 2025-12-31

BUY25
Company Name: ChicCharm

Points Required: 100

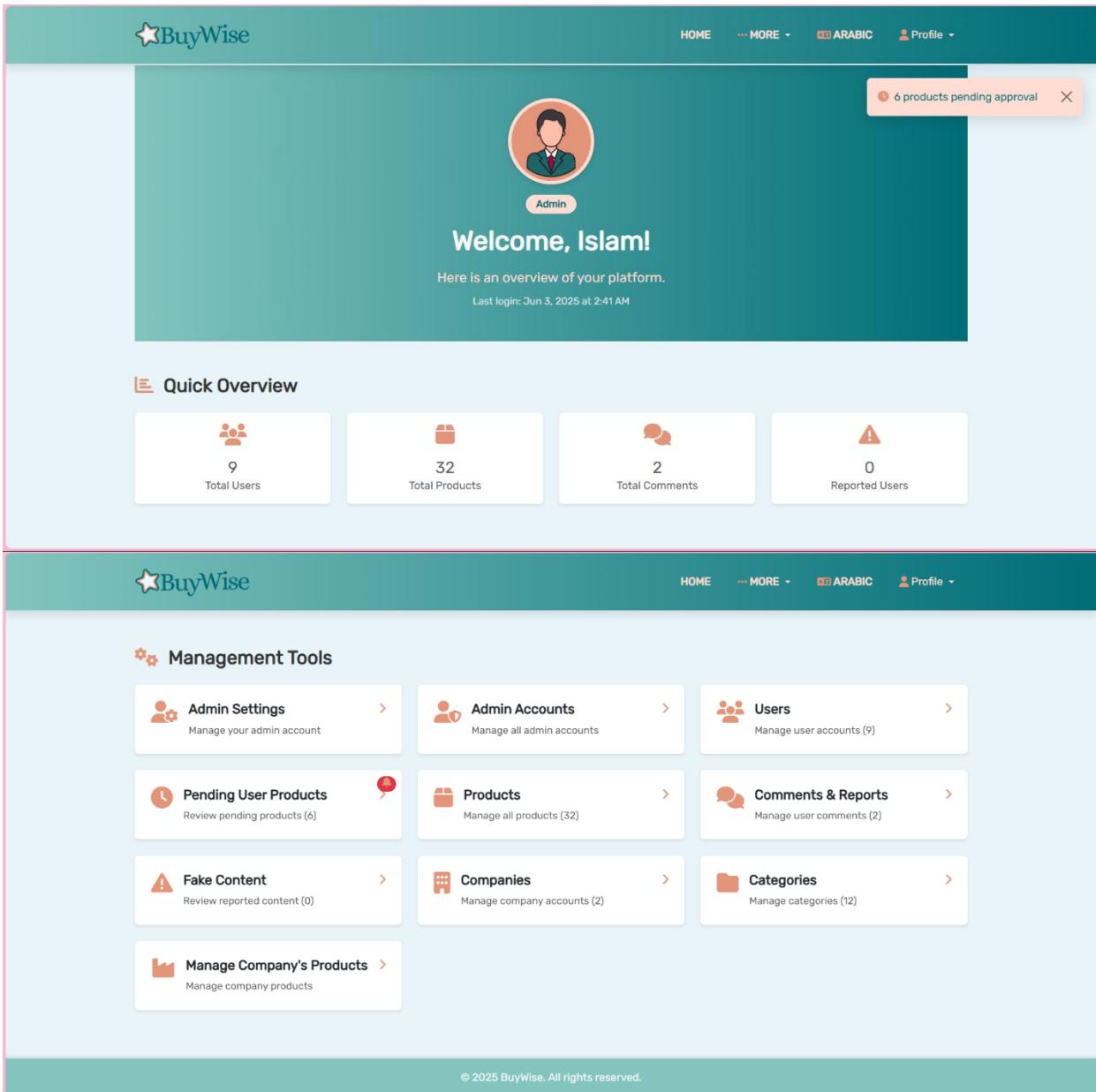
Expiry Date: 2025-12-31

Glam50
Company Name: GlamShine

Points Required: 500

Expiry Date: 2025-06-14

C.3 Admin:



The image displays two screenshots of the BuyWise admin dashboard, separated by a vertical pink line.

Top Screenshot (Dashboard Overview):

- Header:** BuyWise logo, navigation links (HOME, MORE, ARABIC, Profile), and a notification bubble indicating "6 products pending approval".
- User Profile:** Circular profile picture of an admin, labeled "Admin".
- Welcome Message:** "Welcome, Islam!"
- Platform Overview:** "Here is an overview of your platform." and "Last login: Jun 3, 2025 at 2:41 AM".
- Quick Overview:** Four cards showing statistics: Total Users (9), Total Products (32), Total Comments (2), and Reported Users (0).

Bottom Screenshot (Management Tools):

- Header:** BuyWise logo, navigation links (HOME, MORE, ARABIC, Profile).
- Section Header:** "Management Tools" with a gear icon.
- Tools List:** A grid of management tools:
 - Admin Settings:** Manage your admin account.
 - Pending User Products:** Review pending products (6).
 - Fake Content:** Review reported content (0).
 - Manage Company's Products:** Manage company products.
 - Admin Accounts:** Manage all admin accounts.
 - Products:** Manage all products (32).
 - Companies:** Manage company accounts (2).
 - Comments & Reports:** Manage user comments (2).
 - Categories:** Manage categories (12).
- Footer:** © 2025 BuyWise. All rights reserved.

Manage Account

Admin Name

Islam

Email

islamemad1346@gmail.com

To update your password, fill all fields below.

Current Password

(

New Password

(

Confirm Password

(
Update Info

Delete My Account

Add New Admin

Admin Name

Email

Password

+ Add Admin**All Admins**

#	Admin Name	Email	Created At	Actions
1	Islam	islamemad1346@gmail.com	May 16, 2025	Current User



7

Total Users



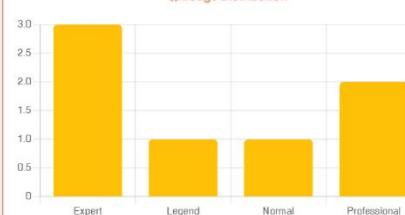
7

Active Users



0

Inactive Users

Gender Distribution**Badge Distribution****Monthly Signups**

[Search](#)

All Users

#	Name	Email	Phone	Address	Birth Date	Gender	Actions
1	Ahmad	islamemadrafati@gmail.com	0799443678			Female	
2	Ahmad Awwad	ahmadtotariq@gmail.com	0780369326			Female	
3	Alma	islamrafati111@gmail.com	0796654429			Female	
4	Malak Zakarneh	malakzakarneh04@gmail.com	0789775305			Female	
5	raghad	raghadt730@gmail.com	0780369326			Female	
6	salwa	salwaqatrmiz30@gmail.com	0780369326			Female	


12

Total Categories


12

Active Categories


0

Inactive Categories

[Add New Category](#)

Select Category Status

No file chosen

Existing Categories

#	Category Name (EN)	Category Name (AR)	Actions
1	Fashion & Accessories	الإِنْدُرَنُوْزُ وَالإِكْسِسُوَارَاتُ	


47

Approved Products


4

Pending Products


0

Deactivated Products

[Filter by Category](#)

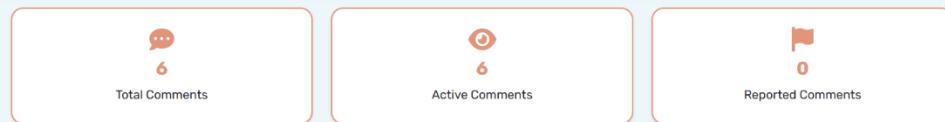
Products - Fashion & Accessories

#	Image	Name	Description	Is Fake	Added By	Actions
1		فستان	الفستان طابع نفيس المصورة بالضيبيط، حتى أح...		raghad	



Reported Users Management

#	User	Fake	Real	Unverified	Total	Last Report	Status	Actions
1	@ sanaa	8	4	0	12	Jun 3, 2025	2 to 5-day ban	



Filter Comments

Category: All Categories | Product: Search for a product... | Apply

All Comments

#	Product	Comment	Status	User	Date	Actions
1	book	Loved the ideas in this one	real	Ahmad	June 3, 2025	

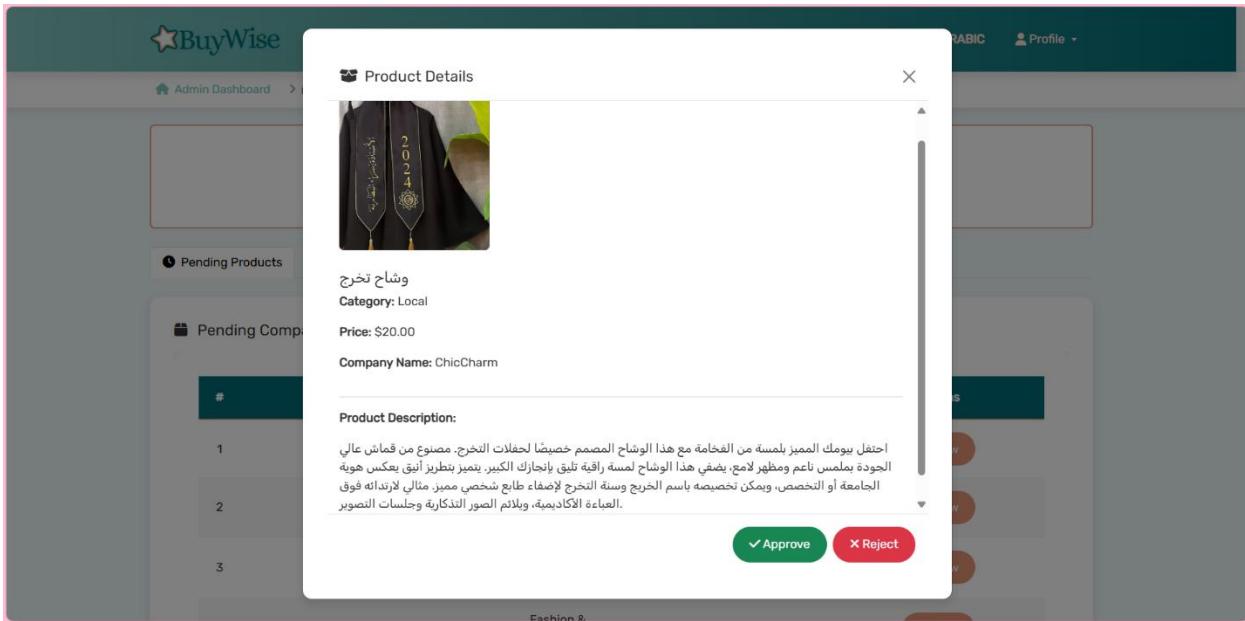


Pending Company Accounts

No pending companies found.

Approved Companies

#	Company Name	Company Email	Country	joined Date	Actions
1	ChicCharm	islamemad079@gmail.com	Jordan	May 16, 2025	



3.4 AI Fake Reviews Detection:

I've been using this product for a few days now and it works perfectly. The quality is great, it's easy to use, and it arrived on time. I didn't expect much for the price, but I was pleasantly surprised. I'd definitely recommend it to anyone looking for something reliable and affordable.

Failed
Your review was flagged as fake.

OK

Add Review

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Notifications

BuyWise System ⚠️
Your recent review was flagged as potentially inauthentic.

Jun 3, 10:16

[View All](#)

[Upgrade Plan](#)[HOME](#)[... MORE](#)[ARABIC](#)[Profile](#)

I love Minnetonka shoes! They always look refreshing and no one else has them!

Submitted

Comment added and points updated
successfully.

OK

Upload an image (optional)

Choose an image

Add Review

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[Upgrade Plan](#)[HOME](#)[... MORE](#)[ARABIC](#)[Profile](#)

Customer Reviews (13)

Filter by Rating:

Sort by:

See what other customers are saying



رغم طارق عواد ★★★★★

June 3, 2025 at 10:23 am

Quality: Excellent

I love Minnetonka shoes! They always look refreshing and no one else has them!

0

Notifications



BuyWise System



You earned 6 points for reviewing a
Local product.

Jun 3, 10:23

[View All](#)



D. Code Snippet

Home page:

```
Home.php X
Home.php
192 <body class="home">
193
194 <section class="hero-buywise container-fluid d-flex align-items-center justify-content-center">
195   <div class="container py-5">
196     <div class="row align-items-center">
197       <!-- Left: Hero Text -->
198       <div class="col-lg-6 text-center text-lg-start hero-content">
199         <h1 class="hero-title">
200           <?= __('buywise_hero_main') ?> <span class="hero-highlight"><?= __('buywise_hero_focus') ?><
201           </h1>
202         <p class="hero-subtitle">
203           <?= __('buywise_hero_desc') ?>
204         </p>
205         <div class="d-flex flex-wrap justify-content-center justify-content-lg-start btn-group-hero">
206           <a href="login.php" class="btn hero-btn-primary">
207             <i class="fas fa-rocket me-2"></i><?= __('get_started') ?>
208           </a>
209           <a href="#categories" class="btn hero-btn-outline">
210             <i class="fas fa-compass me-2"></i><?= __('browse_categories') ?>
211           </a>
212         </div>
213       </div>
214
215       <!-- Right: Hero Image -->
216       <div class="col-lg-6 text-center mt-5 mt-lg-0">
217         <div class="hero-image-container">
218           
219         </div>
220       </div>
221     </div>
222   </div>
223 </section>
224
225 $sliderImages = [];
226 $sliderQuery = $con->query("
227   SELECT p.ProductID, p.ProductImage, p.ProductName,
228     COALESCE(AVG(c.Rating), 0) AS AvgRating, COUNT(c.CommentID) AS ReviewCount,
229     cat.CategoryName_en
230   FROM products p
231   JOIN categories cat ON p.CategoryID = cat.CategoryID
232   LEFT JOIN comments c ON p.ProductID = c.ProductID AND c.CommentStatus = 1
233   WHERE p.ProductImage IS NOT NULL AND p.ProductImage != ''
234     AND p.ProductStatus = 1
235     AND cat.CategoryName_en = 'Local'
236   GROUP BY p.ProductID
237   ORDER BY RAND()
238   LIMIT 5
239 ");
240
241 if ($sliderQuery) {
242   while ($row = $sliderQuery->fetch_assoc()) {
243     $sliderImages[] = [
244       'id' => $row['ProductID'],
245       'path' => 'uploads/products/' . $row['ProductImage'],
246       'name' => $row['ProductName'],
247       'rating' => round($row['AvgRating']),
248       'review_count' => $row['ReviewCount'],
249       'badge' => 'jo Local',
250       'badge_type' => 'local'
251     ];
252   }
253 }
```

Login Page:

```
login.php
1 <?php
2 // Session & Security
3 @session_start();
4 require_once 'lang.php';
5
6
7 // CSRF token (Cross-Site Request Forgery)
8 if (empty($_SESSION['csrf_token'])) {
9     $_SESSION['csrf_token'] = bin2hex(random_bytes(32)); //2 بـ عفان هيك هربنا بـ 32
10 }
11
12 // Language handling
13 $langOptions = ['en', 'ar'];
14 if (isset($_GET['lang']) && in_array($_GET['lang'], $langOptions)) {
15     $_SESSION['lang'] = $_GET['lang'];
16     header("Location: " . htmlspecialchars(strtok($_SERVER["REQUEST_URI"], '?')));
17     exit();
18 }
19
20 $lang = $_SESSION['lang'] ?? 'en';
21 // Force LTR direction regardless of language
22 $dir = 'ltr';
23
24 // Redirect if already logged in
25 // تتحقق إذا كانت متغيرات موجودة وعندئذ امثل
26 if (isset($_SESSION['type'])) {
27     if ($_SESSION['type'] == 1) {
28         header("location: ../Dashboard.php");
29         exit();
30     } else if ($_SESSION['type'] == 2) {
31         header("location: Profile.php");
32         exit();
33 }
```

Profile page:

```
<!-- Pagination -->
<?php if ($total_pages > 1): ?>
    <div class="pagination-container">
        <ul class="pagination">
            <li class="prev <?php echo ($current_page <= 1) ? 'disabled' : ''; ?>">
                <?php if ($current_page <= 1): ?>
                    <span>Previous</span>
                <?php else: ?>
                    <a href="?page=<?php echo $current_page - 1; ?>">Previous</a>
                <?php endif; ?>
            </li>

            <?php
                // Determine which page numbers to show
                $start_page = max(1, min($current_page - 1, $total_pages - 4));
                $end_page = min($total_pages, max($current_page + 1, 5));

                // Always show first page
                if ($start_page > 1): ?>
                    <li class="page-item"><a href="?page=1">1</a></li>
                    <?php if ($start_page > 2): ?>
                        <li class="page-item disabled"><span>...</span></li>
                    <?php endif; ?>
                <?php endif; ?>

                <?php for ($i = $start_page; $i <= $end_page; $i++): ?>
                    <li class="page-item" <?php echo ($i == $current_page) ? 'active' : ''; ?>">
                        <a href="?page=<?php echo $i; ?>"><?php echo $i; ?></a> <!--
                    </li>
                <?php endfor; ?>
```

Categories Section:

```
<!-- Categories Section -->
<section id="categories" class="categories-section">
    <!-- <div class="categories-bg-decoration"></div> -->
    <div class="container">
        <div class="section-header">
            <div class="section-badge">
                <?php
                    <?=_('shop_by_category') ?>
            </div>
            <h2 class="section-title">
                <?=_('categories_title') ?>
            </h2>
        </div>

        <div class="categories-grid">
            <?php
                $nameField = ($lang === 'ar') ? 'CategoryName_ar' : 'CategoryName_en';
                $stmt = $con->prepare("SELECT CategoryID, $nameField AS CategoryName, CategoryImage FROM categories WHERE ");
                if ($stmt) {
                    $stmt->execute();
                    $result = $stmt->get_result();
                    if ($result->num_rows > 0):
                        $i = 0;
                        while ($cat = $result->fetch_assoc()):
                            $categoryImage = !empty($cat['CategoryImage']) ? htmlspecialchars($cat['CategoryImage']) : 'default-image.jpg';
                            $delay = 0.1 + ($i * 0.1);
                            ?>
                            <div class="category-card" style="--delay: <?= $delay ?>s;">
                                <div class="category-image-wrapper">
                                    " loading="lazy" class="category-full-img">
                                </div>
                            </div>
                        
```

Products page:

```
<!-- Image Modal -->
<div id="imageModal" class="image-modal">
    <span class="close-modal" onclick="closeImageModal()">&times;
    <img class="modal-content" id="modalImage">
</div>

</div>
</div>

<?php if (isset($_SESSION['type'])) && $_SESSION['type'] == 2): ?>
    <div class="add-comment-card">
        <h2><?=_('add_your_review') ?></h2>
        <form id="comment-form" class="comment-form" enctype="multipart/form-data">
            <div class="rating-container">
                <p><?=_('your_rating') ?></p>
                <div class="star-rating">
                    <input type="radio" id="star5" name="rating" value="5" />
                    <label for="star5" title="5 stars"><i class="fas fa-star"></i></label>
                    <input type="radio" id="star4" name="rating" value="4" />
                    <label for="star4" title="4 stars"><i class="fas fa-star"></i></label>
                    <input type="radio" id="star3" name="rating" value="3" />
                    <label for="star3" title="3 stars"><i class="fas fa-star"></i></label>
                    <input type="radio" id="star2" name="rating" value="2" />
                    <label for="star2" title="2 stars"><i class="fas fa-star"></i></label>
                    <input type="radio" id="star1" name="rating" value="1" />
                    <label for="star1" title="1 star"><i class="fas fa-star"></i></label>
                </div>
            </div>
        </form>
    </div>

```

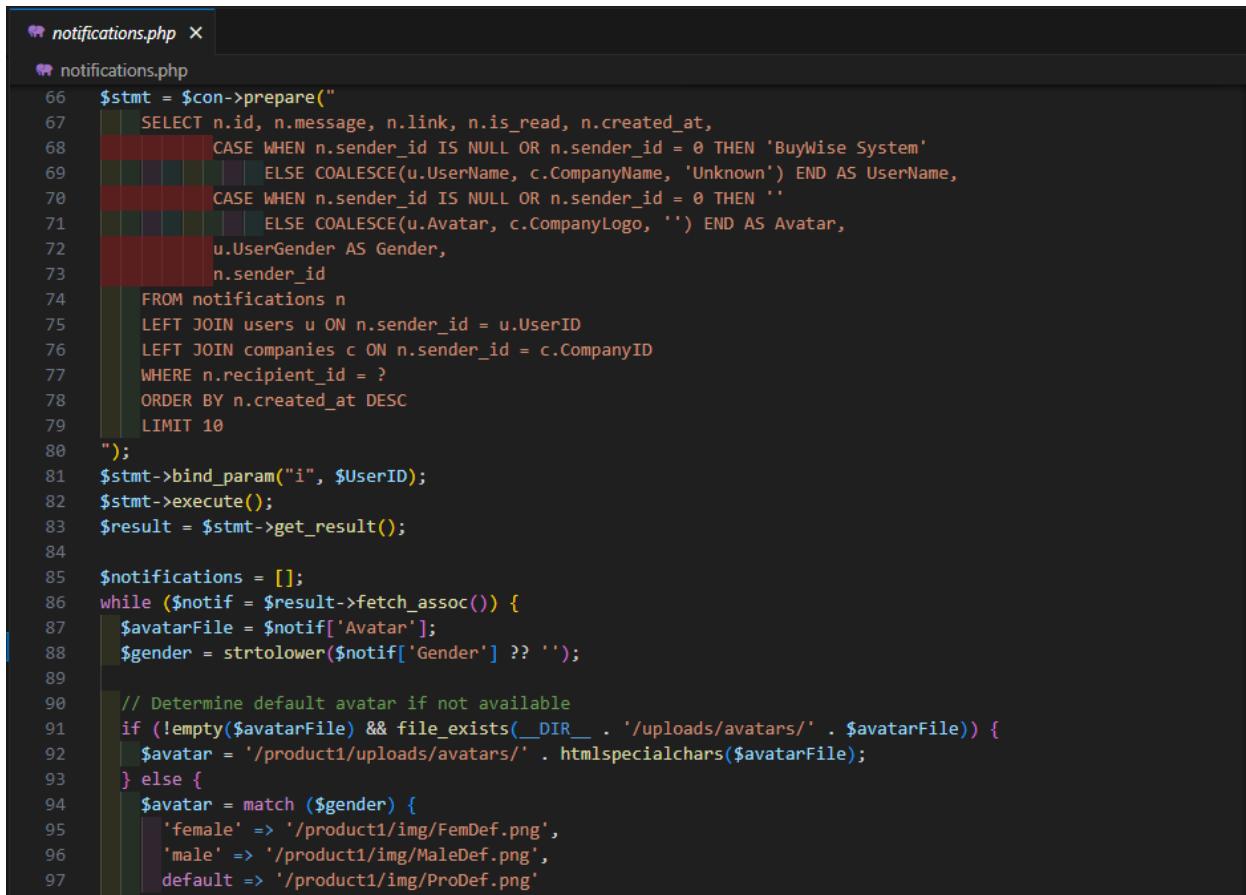
Reward Center:

```
106 // Fetch available vouchers
107 $voucherQuery = $con->query("SELECT cv.VoucherID, cv.VoucherCode, cv.MinPoints, cv.ExpiryDate, c.CompanyName
108     FROM company_vouchers cv
109     JOIN companies c ON cv.CompanyID = c.CompanyID
110     WHERE cv.ExpiryDate >= CURDATE()
111     ORDER BY cv.MinPoints ASC");
112 ?>
113
114 <!DOCTYPE html>
115 <html lang="<?= $lang ?>" dir="<?= $dir ?>">
116 <head>
117     <title><?= __('rewards_center') ?> | BuyWise</title>
118     <link rel="icon" href="img/favicon.ico">
119     <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.3/dist/css/bootstrap.min.css" rel="stylesheet">
120     <link rel="stylesheet" href="User.css">
121 </head>
122 <body>
123     <?php include 'header.php'; ?>
124
125     <div class="container py-5">
126         <h2 class="mb-4"><?= __('rewards_center') ?></h2>
127         <?php if ($isUser): ?>
128             <div class="mb-3">
129                 <strong><?= __('your_points') ?></strong> <?= $userPoints ?>
130             </div>
131         <?php endif; ?>
132
133         <?php if ($voucherQuery->num_rows > 0): ?>
134             <div class="row row-cols-1 row-cols-md-3 g-4">
135                 <?php while ($voucher = $voucherQuery->fetch_assoc()): ?>
136                     <div class="col">
137                         <div class="card h-100 shadow-sm border-0">
```

FAQ page:

```
167 <div class="faq-container">
168     <?php
169     $faqs = [
170         'faq_register',
171         'faq_no_verification',
172         'faq_reset_password',
173         'faq_add_product',
174         'faq_badges',
175         'faq_points',
176         'faq_rewards',
177         'faq_interaction',
178         'faq_report',
179         'faq_languages',
180         'faq_notifications',
181         'faq_profile_visibility',
182         'faq_account_update'
183     ];
184
185     foreach ($faqs as $key) {
186         echo '
187             <div class="faq-item">
188                 <button class="faq-question">' . __('' . $key . '') . '</button>
189                 <div class="faq-answer">' . __('' . $key . '_ans') . '</div>
190             </div>';
191     }
192     ?>
193 </div>
194 </main>
```

Notifications:



```
notifications.php X
notifications.php
66 $stmt = $con->prepare("
67     SELECT n.id, n.message, n.link, n.is_read, n.created_at,
68         CASE WHEN n.sender_id IS NULL OR n.sender_id = 0 THEN 'BuyWise System'
69             ELSE COALESCE(u.UserName, c.CompanyName, 'Unknown') END AS UserName,
70         CASE WHEN n.sender_id IS NULL OR n.sender_id = 0 THEN ''
71             ELSE COALESCE(u.Avatar, c.CompanyLogo, '') END AS Avatar,
72         u.UserGender AS Gender,
73         n.sender_id
74     FROM notifications n
75     LEFT JOIN users u ON n.sender_id = u.UserID
76     LEFT JOIN companies c ON n.sender_id = c.CompanyID
77     WHERE n.recipient_id = ?
78     ORDER BY n.created_at DESC
79     LIMIT 10
80 ");
81 $stmt->bind_param("i", $UserID);
82 $stmt->execute();
83 $result = $stmt->get_result();
84
85 $notifications = [];
86 while ($notif = $result->fetch_assoc()) {
87     $avatarFile = $notif['Avatar'];
88     $gender = strtolower($notif['Gender']) ?? '';
89
90     // Determine default avatar if not available
91     if (!empty($avatarFile) && file_exists(__DIR__ . '/uploads/avatars/' . $avatarFile)) {
92         $avatar = '/product1/uploads/avatars/' . htmlspecialchars($avatarFile);
93     } else {
94         $avatar = match ($gender) {
95             'female' => '/product1/img/FemDef.png',
96             'male' => '/product1/img/MaleDef.png',
97             default => '/product1/img/ProDef.png'
```

Company Add Voucher:



```
72 <div class="card shadow p-4 mb-4">
73     <h4 class="mb-3"><?= __('add_new_voucher') ?></h4>
74     <form method="post" class="row g-3">
75         <div class="col-md-3">
76             <label class="form-label"><?= __('voucher_code') ?></label>
77             <input type="text" name="VoucherCode" class="form-control" required>
78         </div>
79         <div class="col-md-3">
80             <label class="form-label"><?= __('discount_value') ?> (%)</label>
81             <input type="number" name="Discount" step="0.01" min="0.1" max="100" class="form-control" required>
82         </div>
83         <div class="col-md-3">
84             <label class="form-label"><?= __('min_points_required') ?></label>
85             <input type="number" name="MinPoints" min="0" class="form-control" required>
86         </div>
87
88         <div class="col-md-3">
89             <label class="form-label"><?= __('expiry_date') ?></label>
90             <input type="text" id="ExpiryDate" name="ExpiryDate" class="form-control" required
91                 placeholder=<?= $lang === 'ar' ? 'اختر تاريخ الانتهاء' : 'Select expiry date' ?>>
92         </div>
93
94         <div class="col-12 text-end">
95             <button type="submit" class="btn btn-primary"><?= __('add_voucher') ?></button>
96         </div>
97     </form>
98 </div>
```

Admin Dashboard:

```
Dashboard.php 1M X
Admin > Dashboard.php
14 // Get dashboard stats
15 $stats = [];
16 try {
17     $stats['users'] = $con->query("SELECT COUNT(*) as count FROM users WHERE UserStatus = 1")->fetch_assoc()['count'];
18     $stats['products'] = $con->query("SELECT COUNT(*) as count FROM products WHERE ProductStatus = 1")->fetch_assoc()['count'];
19     $stats['pending_products'] = $con->query("SELECT COUNT(*) as count FROM products WHERE ProductStatus = 0 AND Status = 'Pending'");
20     $stats['comments'] = $con->query("SELECT COUNT(*) as count FROM comments")->fetch_assoc()['count'];
21     $stats['reported_users'] = $con->query("SELECT COUNT(DISTINCT UserID) as count FROM reported_reviews")->fetch_assoc()['count'];
22     $stats['companies'] = $con->query("SELECT COUNT(*) as count FROM companies")->fetch_assoc()['count'];
23     $stats['categories'] = $con->query("SELECT COUNT(*) as count FROM categories")->fetch_assoc()['count'];
24     $stats['new_users_week'] = $con->query("SELECT COUNT(*) as count FROM users WHERE DATE(CreatedAt) >= DATE_SUB(NOW(), INTERVAL 7 DAY)")->fetch_assoc()['count'];
25 } catch (Exception $e) {
26     $stats = array_fill_keys(['users', 'products', 'pending_products', 'comments', 'reported_users', 'companies'], 0);
27 }
28
29 // Dashboard menu
30 $menuOptions = [
31     [
32         'link' => 'AdminAccount.php',
33         'icon' => 'fa-user-cog',
34         'title' => __('admin_settings'),
35         'description' => __('manage_your_admin_account'),
36         'color' => 'style="background-color: var(--accent-light);"',
37         'urgent' => false
38     ],
39     [
40         'link' => 'AdminManageAdmins.php',
41         'icon' => 'fa-user-shield',
42         'title' => __('admin_admins'),
43         'description' => __('manage_admin_accounts'),
44         'color' => 'style="background-color: var(--accent-light);"',
45         'urgent' => false
46     ]
47 ];
```

Account Settings:

```
// Handle form submission
if ($_SERVER['REQUEST_METHOD'] === 'POST') {
    $AdminName = trim($_POST['AdminName'] ?? '');
    $AdminEmail = trim($_POST['AdminEmail'] ?? '');
    $CurrentPassword = $_POST['CurrentPassword'] ?? '';
    $NewPassword = $_POST['AdminPassword'] ?? '';
    $ConfirmPassword = $_POST['ConfirmPassword'] ?? '';

    // Get current admin password
    $stmt = $con->prepare("SELECT AdminPassword FROM admins WHERE AdminID = ?");
    $stmt->bind_param("i", $AdminID);
    $stmt->execute();
    $adminData = $stmt->get_result()->fetch_assoc();
    $stmt->close();

    if (!$adminData) {
        $_SESSION['popup'] = __('admin_not_found');
        header("Location: " . $_SERVER['REQUEST_URI']);
        exit();
    }

    $hasError = false;

    // Email uniqueness check
    if (!empty($AdminEmail)) {
        $stmt = $con->prepare("SELECT AdminID FROM admins WHERE AdminEmail = ? AND AdminID != ?");
        $stmt->bind_param("si", $AdminEmail, $AdminID);
        $stmt->execute();
        if ($stmt->get_result()->num_rows > 0) {
            $_SESSION['popup'] = __('email_in_use');
            $hasError = true;
        }
        $stmt->close();
    }
}
```