



Design and Implementation of a Mobile E-Commerce Platform Based-on Machine Learning

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Abstract— In this paper, the “STORY”, which is an e-commerce mobile platform, is developed based-on machine learning techniques in order to consolidate selling methods into a unified, efficient, and personalized environment. Also, to elevate user experiences, and cultivate a thriving e-commerce environment in Libya. STORY is designed to serve the needs of both customers and merchants, aiming to bridge the gap between consumer demands and efficient business interactions. This platform strives to provide customers with a wide range of services and functions that match their preferences, while empowering merchants with a user-friendly mobile interface for effective business management. Among its notable features, STORY boasts an image-based search function, which simplifies the process of searching for desired or similar products. Additionally, the platform integrates an intelligent recommendation system capable of tracking and analyzing customer behaviors within the platform. This system collects pertinent data to offer personalized product recommendations and tailored offers, elevating the shopping experience. The system underwent an evaluation via a questionnaire, which had overwhelmingly positive results. User feedback and satisfaction regarding the system's functionalities and performance were notably favorable.

Index Terms— e-commerce, mobile application, machine learning techniques, recommendation system, image-based search.

I. INTRODUCTION

Information and communications technology has evolved over time, which has the ability to play an important role in developing and improving services for distributing services and solutions in the business sectors simplifying daily tasks [1]. Nowadays, finding everything one needs remotely has become effortlessly achievable with a few clicks, provided there's a reliable internet connection. As in all other spheres of life, the commercial field has also evolved in tandem with technological advancement. With electronic commerce, people may now purchase and obtain the things they need without ever leaving their houses.

Information and communications technology has the ability to play an important role in developing and improving services for distributing services and solutions in the business sectors Electronic commerce, commonly known as e-commerce, constitutes the exchange of products or services facilitated through computer networks, prominently the Internet. This transformative mode of trade has experienced an exponential surge in popularity, aligning with the swift and expansive growth of the Internet's reach and capabilities. The ascent of e-commerce, including both Business-to-Consumer (B2C) and Business-to-Business (B2B) interactions, has remarkably surged to the forefront of contemporary business strategies [2]. This pivotal shift is entrenched in the increasing demand for online services, compounded further by the indispensable role of technology in catering to the needs of modern consumers. The integration of the internet into the fabric of daily life is nothing short of remarkable, according to Statista [3], in January 2024, there were 5.35 billion (66.2 percent of the global population), internet users worldwide.

The e-commerce domain serves as the nexus where innovation, convenience, and consumer preferences converge. In the B2C sphere, direct sales from businesses to end consumers redefine retail paradigms, while B2B transactions underpin inter-company commerce. Irrespective of the domain, the overarching objective remains consistent, facilitating seamless access to goods and services across diverse digital platforms, transcending geographical constraints and temporal limitations.

Moreover, with the widespread use of smartphones, mobile e-commerce has become an integral part of our daily lives. An e-commerce mobile application is a digital platform specifically designed and developed for handheld devices that facilitates online buying and selling of goods or services.

Of the various technological advancements shaping this landscape, Machine Learning (ML) stands at the forefront, exerting a profound influence on the dynamics of e-commerce. The application of machine learning

technologies has redefined the consumer experience. Through advanced systems and recommendation engines, machine learning not only facilitates seamless transactions but also enhances immersive engagements, catering to the diverse needs of an increasingly digital consumer base.

Within the context of Libya, the landscape of electronic commerce predominantly relies on social media platforms. Merchants utilize these platforms to showcase their products, initiating customer orders through phone calls or messaging channels. This method necessitates the collection of customers' personal information each time they make an order for subsequent communication regarding delivery arrangements. Additionally, a secondary approach involves the development of institution-specific applications to exhibit their product catalog.

In the Libyan market, a limited number of e-commerce mobile applications are present. Registering for these platforms entails a sequence of procedures and contractual arrangements between the application's operating company and sellers interested in joining the platform. This limited accessibility has resulted in ineffective interaction between the system and customers. Consequently, customers lack personalized experiences as their specific requirements and interests remain unspecified. Most applications employ a simplistic keyword-based search method, limiting product discovery solely to product or brand names.

The prevailing e-commerce landscape in Libya encounters multifaceted challenges. The reliance on social media as the primary transaction medium lacks standardization, resulting in disparate processes and impeding the establishment of a unified and streamlined electronic marketplace. This fragmentation not only hampers user experiences but also restricts scalability and accessibility. As a result, there's an urgent need for an integrated and standardized e-commerce platform tailored to Libya's market.

Therefore, this study is interested in designing and implementing a mobile e-commerce platform called STORY, which aimed to consolidate various selling methods into a unified, efficient, and personalized experience. STORY seeks to overcome the limitations of the current landscape by facilitating enhanced interactions, personalized experiences, and advanced search features. By centralizing disparate selling practices into one platform, STORY endeavors to streamline processes, provide customers with a wide array of services and functionalities that match their preferences, elevate user experiences, and cultivate a thriving mobile e-commerce environment in Libya.

Among its standout features, STORY boasts an image-based search function, simplifying the quest for desired or similar products. Additionally, the platform integrates an intelligent recommendation system capable of tracking and analyzing customer behaviors both within the platform. Finally, tested the e-commerce system, and customer satisfaction is high.

II. LITERATURE REVIEW

A. *Mobile E-commerce Applications*

Electronic commerce or e-commerce is the term used to describe any economic activity, such as selling, buying or exchanging products and services over the Internet [4]. Accordingly, mobile e-commerce or m-commerce can be defined as an extension of e-commerce, as the two terms are similar to each other. They both share basic business principles. More specifically, m-commerce is just one of the many subsets of e-commerce in which all the transactions are connected via handheld devices such as mobile phones, and their interaction occurs in a wireless mode.

Recent developments in digital payment infrastructure, coupled with the advent of smartphones and the Internet, have spurred the mobile commerce revolution around the world. Mobile e-commerce applications allow online sellers to offer personalized shopping experiences through easy-to-use features. The benefits of personalized offers, and faster shopping experiences have led online shoppers to prefer mobile applications over the other online shopping ways [5].

B. *Review on Existing E-commerce Applications*

The shopping landscape has seen a major shift due to the surge of online stores. This review delves into some online shopping mobile apps in Libya that have been developed during the last years, exploring the dynamic world of e-commerce applications, seeking to unravel their intricacies and user experiences. The review highlights four established e-commerce applications that have gained recognition in the Libyan market.

- **Jibli-Mall**

Jibli Mall is the pioneer in Libya, introducing comprehensive Quick Commerce Super App that has transformed the way people shop. Jibli-Mall offers a convenient and seamless solution for purchasing essential products whenever they are needed. The app is accessible on both Android and iOS platforms and guarantees prompt and dependable delivery to all areas of Tripoli, Libya. This aligns with the description provided on their website (www.jibli.ly).

- **Spiza**

The Spiza application (www.spiza.ly) was established in 2018 and has been downloaded by 50,000 users, according to the company's statistics. This application serves as an intermediary between sellers and customers who are registered in the program. Presently, Spiza operates exclusively within the city of Benghazi. To include a business activity within the Spiza program, individuals or businesses need to submit a request through the company's website. The request undergoes a review process, which includes communication with the seller and the preparation of a contract to activate the business activity. To make a purchase through this program, users must first log in. Registration necessitates providing a phone number and a delivery address. Once logged in, users can place orders, track order status, and access order details through the ordering interface.

- **E-zad**

This company offers sales and delivery services through its application, which hosts multiple stores. Additionally, the company has established agreements with numerous local suppliers and wholesalers. To become a registered store within the application, individuals or businesses need to engage in a personal contract with the company and create a commercial agreement, enabling them to showcase their products within the program. Customers can make purchases from the program by choosing from the variety of stores it offers, with the assurance of a swift delivery service (www.elzad.ly).

- **Click-shop**

Click Shop is a prominent company specializing in connecting customers with various restaurants and stores through the convenience of the internet. It offers a user-friendly and efficient way for customers to place orders. Whether you're using a personal computer, mobile phone, or tablet, you can easily make your selection through Click Shop. The process is straightforward: once a customer submits an order, Click Shop's program swiftly relays the order to the respective restaurant or store. The company takes the responsibility of ensuring the order reaches its destination on time. For merchants interested in joining the app, registration is possible by submitting an application through the company's website dedicated to the app (www.clickshop.net).

The following comparison table presents an analysis of four applications in the Commerce and delivery service industry. This comparative evaluation aims to provide a comprehensive overview of these applications' key features. By examining the strengths and weaknesses of these services.

TABLE 1 REVIEW ON EXISTING E-COMMERCE APPLICATIONS

Applications	Recommendation System	Personalized Suggestions	Search Type	Platform	Chat Features
Jibli-Mall	No	No	Keyword-based	Android, iOS	No
Spiza	No	No	Keyword-based	Android, iOS	No
E-zad	Yes	No	Keyword-based And QR code	Android, iOS	No
Click-shop	Yes	No	Keyword-based	Android, iOS	No

C. Machine Learning in a Mobile E-commerce

In the constantly evolving realm of e-commerce, mobile devices have emerged as a primary platform for online shopping. This shift towards mobile has created opportunities for businesses to leverage machine learning techniques in improving the shopping experience, tailoring interactions, and boosting sales. As a subset of artificial intelligence, ML empowers computers to learn from data, rendering it a potent instrument for optimizing strategies in mobile e-commerce.

This research paper delves into three ML applications. Firstly, the investigation into image search functionalities

aims to transcend conventional text-based searches, enabling users to explore products effortlessly through visual input. Secondly, the study of recommendation engines seeks to personalize user experiences by suggesting products aligned with individual preferences and browsing history. Lastly, the utilization of a background remover for images aims to elevate product visuals, enhancing their appeal and presentation.

Search by image, commonly known as reverse image search, is an innovative and powerful technology that enables users to uncover information, find related images, and access content by using an image as the query instead of traditional text-based input. In conventional text-based search engines, users input keywords to retrieve relevant results. However, with image search, users can upload or provide an image, and the search engine responds by presenting results that encompass visually similar or related images, websites, products, and a diverse array of content. This transformative approach has redefined how users navigate and interact with digital information.

Content-based image retrieval (CBIR) is a technique used for retrieve similar images from a database. The most challenging aspect of CBIR is to bridge the gap between the low-level feature layout and high-level semantic concepts [6]. Convolutional Neural Network (CNN) is a machine learning method which has been successfully applied to the field of image classification. The structure roughly mimics the nature of the mammalian visual cortex and neural networks in the brain. It is inspired by the human visual system because of its ability to recognize and localize objects within cluttered scenes [7]. The evolution of image retrieval methodologies has seen remarkable strides, notably propelled by groundbreaking contributions in the field. Babenko and Lempitsky [8] introduced a groundbreaking approach in the domain of image retrieval, unveiling a novel descriptor named SPoC (sum-pooled convolutional features), heralding a remarkable leap in retrieval accuracy compared to preceding deep feature-based descriptors. It distinctly emphasizes the necessity to reevaluate established computer vision techniques when applied to deep convolutional features, elucidating the unique characteristics inherent in these descriptors compared to conventional ones like SIFT (Scale-Invariant Feature Transform).

Recommendation engine is a type of data filtering tool that uses machine learning algorithms to provide personalized recommendations to users based on their preferences and past behaviors. In realm of e-commerce, recommendation systems are used to support consumer choice in the e-commerce applications. Such systems are developed to predict a set of items that may be interesting to a specific customer in the absence of information about the choice of specified product by this user. In making recommendations data on the choice of other users, as well as on the characteristics of selected items are used [9]. In the dynamic and rapidly evolving landscape of e-commerce, characterized by an abundance of choices that confront online shoppers, recommendation systems assume the role of indispensable digital shopping companions. These systems constitute the very essence of personalized shopping experiences. They play a pivotal role in assisting users as they navigate the expansive

online marketplace, enabling them to make well-informed choices with confidence.

Over the years, several different approaches for generating recommendations have been proposed. Bansal et al. [10] applied GRU-based recurrent neural networks to transform item text into latent features. This approach aimed to enhance collaborative filtering performance, particularly for addressing cold start challenges. They tested the model on a citation recommendation system using real-world datasets from CiteULike, including both dense and sparse versions. Their model was compared with a modified version of collaborative topic modeling. Across both datasets, their proposed model demonstrated statistically significant performance improvements.

Zheng et al. [11] presented DeepCoNN (Deep Cooperative Neural Networks) as a novel approach to recommender systems. DeepCoNN applies deep learning to jointly capture user and item characteristics using reviews. It incorporates two parallel neural networks—one for learning user preferences and another for item properties from reviews. These networks share a top layer, allowing interaction between learned factors for users and items, resembling factorization machines.

Liang and Baldwin [12] introduced a novel recommender system approach called the Probabilistic Rating Auto-Encoder. This system leverages unsupervised feature learning and generates user profiles from user-item rating data to enhance collaborative filtering methods. By adding deep learning to conventional approaches like matrix factorization, particularly with the yelp.com dataset in the e-commerce domain, they observed statistically significant improvements in rating prediction.

V. Paranjape et al. [13] deployed a machine learning approach for item recommendation in e-commerce making use of collaborative based model. This research follows the model based approach using the concept of singular value decomposition (SVD) in order to get the ratings of unrated items and minimize the sparsity problem.

Image background remover, in the realm of image processing, a machine learning-based background remover stands as an advanced technique utilizing deep learning algorithms, particularly convolutional neural networks. Its primary function is to automatically identify and isolate foreground objects from their backgrounds within digital images. The core principle revolves around the algorithm's ability to recognize patterns, textures, and contours, enabling it to accurately delineate the foreground objects and remove the surrounding background.

Inspired by these applications, this paper presents the design and implementation of a mobile e-commerce system using machine learning techniques.

III. METHODOLOGY

The Software Development Life Cycle known as the Iterative Waterfall Model was used for developing this mobile e-commerce application. This approach allows for periodic reviews and adjustments in each phase of development, offering greater flexibility and adaptability to changing requirements and stakeholder feedback while still maintaining the structured, sequential nature of the Waterfall Model. The typical phases in this model include requirements, design, implementation and testing. The details of each phase are given in the following subsections.

A. Requirements

In the pivotal phase of requirements gathering, a comprehensive exploration of the research objectives and stakeholder requirements is systematically conducted. This research used two methods to collect requirements: competitive analysis and market research.

Gathering requirements through competitive analysis is a valuable method for comprehending market trends, customer expectations, and industry best practices. Through the examination of competitors and their offerings, one can derive invaluable insights to inform the development of their own products or services. The advantages of competitive analysis include gaining a deeper understanding of the market landscape, learning about customer preferences and expectations.

Market research encompasses the collection, analysis, and interpretation of data related to the market and potential customer base. Through meticulous examination, it enables organizations to acquire crucial insights that inform strategic decisions. The advantages of market research include preventing the wastage of resources on ineffective strategies, understanding customer preferences and needs, and proactively addressing potential risks and challenges.

The most important aspect of obtaining a comprehensive picture of the interactions between users and the platform is to perform a system requirements analysis. The paper employs the use of use case diagrams to model user interactions with system components. This serves the purpose of identifying and elucidating user requirements. The main functions of the system, as depicted in Figure 1, represents the core operations and activities that the system is designed to carry out. These functions hold critical importance, as they are essential in guaranteeing the system's effective realization of its intended goals and in meeting the needs of its users.

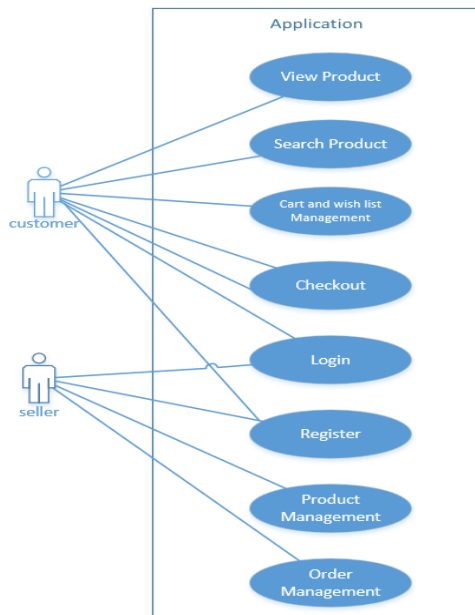


FIGURE 1. MAIN FUNCTIONS OF THE SYSTEM

B. System Design

This paper aims to develop and design a mobile e-commerce platform application named STORY. Figure 2 describes the system.

The mobile application for e-commerce is comprised of essential sections that cater to different functions. To ensure the safety of users, User Authentication module authenticates their login and registration details. The Product Listing feature organizes all available products, while the Image Processing module optimizes visuals for an appealing display. Easy item discovery is facilitated by the Product Search module. Customer Messaging module caters to user-support interactions.

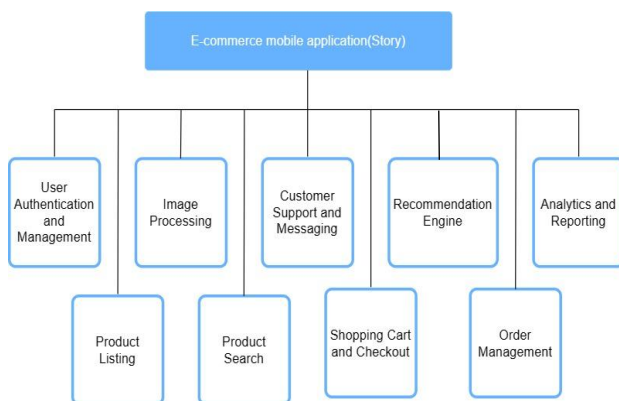


FIGURE 2. SYSTEM MODULES

Furthermore, seamless purchase processes are guaranteed with Shopping Cart and Checkout module complemented by Recommendation Engine module providing personalized recommendations. With Order Management handling processing activities as well as tracking orders, Analytics and Reporting module offers valuable insights useful in decision-making processes.

The main entities of the system are: Customers, which contain the personal details of registered users; Stores, which represents seller information and store-specific attributes; Products, and item descriptions available;

Categories, product classification and associated stores; Carts for temporary storage of items specified by customers; Wish lists that allow users to save desired products; orders, and record purchase details.

C. Implementation

The implementation phase marks the transformative transition from abstract concepts and meticulous planning to the tangible realization of the project. It delineates the critical phases of implementation, pivotal in translating design into a functional software solution while ensuring its reliability and compliance with specified requirements. It involves writing the actual code, designing the user interface, structuring the database, and interconnecting all the components.

Implementing the designed system requires consideration of two technical parts, namely programming languages and database.

Programming Languages: the primary programming language employed in this research was Dart, empowering the construction of not only the backend logic but also the mobile frontend component. Its versatility allowed for the seamless integration of the core backend functionalities with the mobile user interface.

PHP which stands for Hypertext Preprocessor, is a versatile and widely adopted scripting language primarily used for web development. It plays a pivotal role in enabling dynamic and interactive web applications. PHP was leveraged as the intermediary layer to establish a robust connection with the database, enabling efficient data retrieval, manipulation, and storage operations.

Python is a versatile and widely acclaimed programming language known for its simplicity, readability, and robust capabilities. It has gained immense popularity across various domains, from web development and data science to artificial intelligence and automation. Python was employed for the implementation of ML algorithms as a crucial component of this work. Python's extensive libraries and frameworks dedicated to ML facilitated the development of intelligent and data-driven functionalities, enhancing the overall system's capabilities.

Node.js is a powerful, open-source JavaScript runtime built on Chrome's V8 JavaScript engine. It allows developers to execute JavaScript code outside of a web browser, making it an exceptional choice for building server-side applications and networked services. Node.js was utilized in the development of a real-time messaging server.

Database: two type of database were used in this work, MySql and MongoDB. MySQL is a widely used open-source relational database management system that plays a fundamental role in managing and storing structured data. MySQL was used for managing the relationships of basic data entities in the system including customers, products, categories, orders and wish lists. Also this paper makes use of a NoSQL database, specifically MongoDB, which is a popular and versatile database designed to efficiently handle unstructured or semi-structured data. MongoDB complements the system's relational database by specifically providing

real-time chat services and capturing user system interactions. In MongoDB, data is organized into collections, which are similar to tables in relational databases. Each collection contains a set of documents, where each document represents an individual item or entity.

Machine learning techniques: In the realm of machine learning implementation, a variety of techniques were used. Singular Value Decomposition (SVD) was utilized for collaborative recommendations, while TF-IDF and cosine similarity integration for content-based recommendations. For image feature extraction, ResNet80 Convolutional Neural Network (CNN) was utilized for both image search and content recommendation, and incorporated ANNOY as the search algorithm. Finally, the extraction of the image's background was successfully accomplished through the utilization of Rembg algorithm. The Rembg algorithm is an advanced tool based on deep learning, specifically utilizing the U-2-Net-L neural network architecture to precisely remove backgrounds from images. This algorithm operates on the principle of semantic segmentation, where it identifies and understands the semantic meaning of different parts of an image.

Furthermore, in this study, Socket.IO a JavaScript library, was used to enable real-time, bidirectional communication between clients (users and devices) and the system servers. It utilizes WebSocket as the underlying protocol to provide low-latency, full-duplex communication channels. To utilize Socket.IO, the initial step involves incorporating the Socket.IO library on both the client and server facets of the application. This ensures seamless communication between the client and server, facilitated by Socket.IO's protocol.

D. Testing

The testing phase ensures the integrity and quality of the system by thoroughly examine the system to uncover and resolve any issues or irregularities. This phase is like a final check to make sure the system functions smoothly and meets the intended requirements. Various types of tests were conducted to address every aspect of the mobile e-commerce application.

Unit testing involves testing each function in the system individually, isolating it from its dependencies to ensure the excellence and correctness of each function. Integration testing is a multifaceted process that extends to data integrity. This phase is crucial in ensuring that data is seamlessly shared and processed between various components, guaranteeing the integrity and reliability of the application.

Furthermore, system restrictions and permissions testing was performed, which is an essential step to ensure that the system accurately enforces access restrictions and permissions assigned to different user roles.

IV. THE PLATEFORM

The STORY platform developed in this research represents a system designed to cater to the requirements

of customers in the realm of buying and selling. Individuals have the option to register on this platform, either as merchants to showcase their products or as customers to peruse and make purchases.

The application is accompanied by a dedicated website shown in Figure 3 that provides detailed insights into the application's features and usage guidelines. User can easily access this website to download the application.

FIGURE 3. STORY WEBSITE

The major objectives of developing STORY

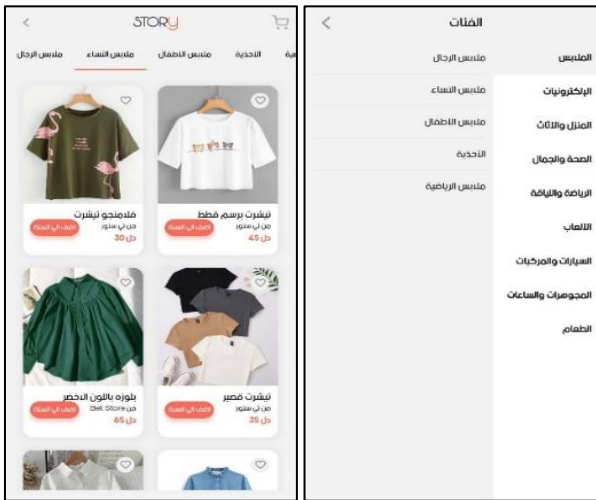


application are to:

- Provide customers with product recommendations based on their behavior and individual preferences to enhances their shopping experience.
- Provide customers multiple search options, including image-based search, and text search to diversifies their browsing experience.
- Provide tools and interfaces for vendors to manage their product listings, inventory, pricing, and order fulfillment efficiently.
- Streamline the order processing and fulfillment process, including order tracking and communication between vendors and customers.
- Offers sellers the opportunity to deal directly with customers via an internal messaging system integrated into the platform, which simplifies the process of inquiries and negotiations.
- Enables sellers to effectively remove the background from product images, thereby enhancing their visual appeal and overall attractiveness.
- Provide vendors with analytics tools to track sales, customer behavior, and other key metrics, enabling data-driven decisions.

- Ensure a user-friendly, seamless shopping experience for customers.

As mentioned earlier, the user can be a customer or a seller, so the application offers two user interfaces, the customer interface and the seller interface.



A. Customer Interface

FIGURE 4. GENERAL CATEGORIES PAGE SCREENSHOT

The customer interfaces serve as the primary interaction point for users browsing and purchasing products. The customer homepage consists of the recommendation product tab, followed store, search, and the general categories page. The general categories page (الفئات) shown in Figure 4, showcases a structured layout presenting various product categories available within the application. It enables users to browse through diverse categories, offering a clear and organized navigation path.

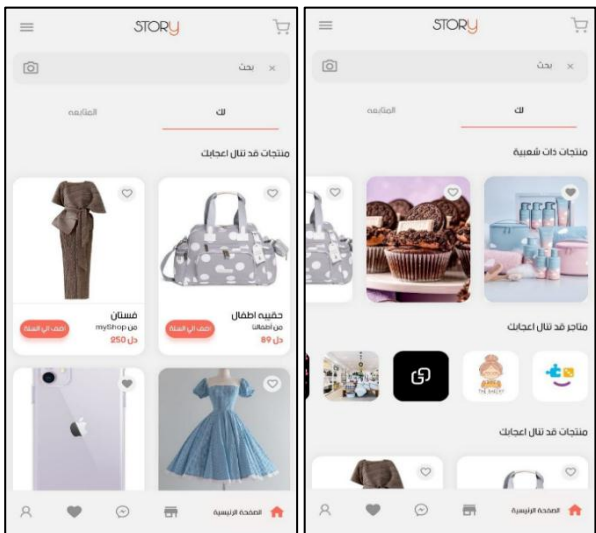
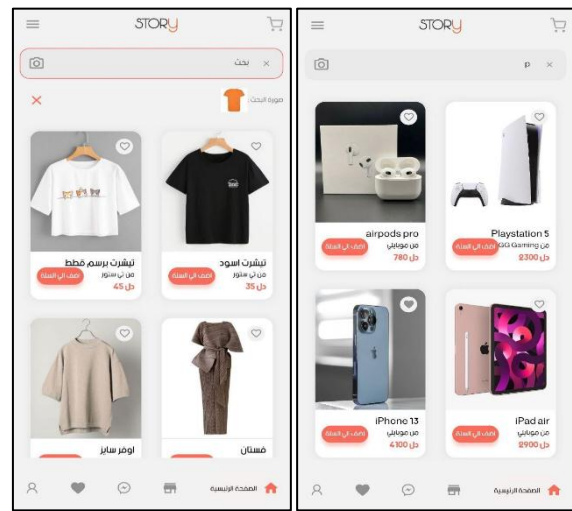


FIGURE 5. RECOMMENDATION PAGE SCREENSHOT

The recommendation product page (لك) described in Figure 5, offers personalized recommendations tailored to individual user preferences. The followed store tab (المتابعة) exclusively showcases products from stores followed by the user. Figure 6 shows the search tab (البحث) offers versatile search capabilities, empowering users to explore products through both text-based queries and image inputs.

FIGURE 6. SEARCH PAGE SCREENSHOT



B. Seller Interface

The Seller homepage consists of the statistics, orders, financial analytics and customers section as shown in Figure 7. The statistics section (الاحصائيات) provides sellers with crucial insights and metrics related to their performance, order volumes, customer acquisition, and daily sales. The Order Analytics section (الطلبات) provides sellers with detailed insights into specific order statuses, analytical drawing displaying the percentage of orders attributed to each category, individual product sales, and sales frequency over different time frames.

The Financial Analytics section (البيانات المالية) visualizes the information about total sales, profits, and profit percentages through bar charts that depict sales and profits over different time periods. In addition, it provides graphs to compare weekly, monthly and yearly sales against previous periods. Furthermore, it provides insights into average order value and breaks down sales figures by product category.

The customer section (العملاء) offers sellers insights into customer acquisition trends, order frequency, and a breakdown of customers based on their order count within various time frames.

FIGURE 7. SELLER HOMEPAGE SCREENSHOT

V. SYSTEM EVALUATION

In the process of evaluating the system, the questionnaire consisting of 12 questions was used. It aims to gather insights into the user experience, identify areas of improvement, and assess overall satisfaction. Each question within the questionnaire has been carefully selected and worded with meticulous precision to effectively measure usability. Questions related to usability cover various aspects, including ease of navigation, task efficiency, and system responsiveness.

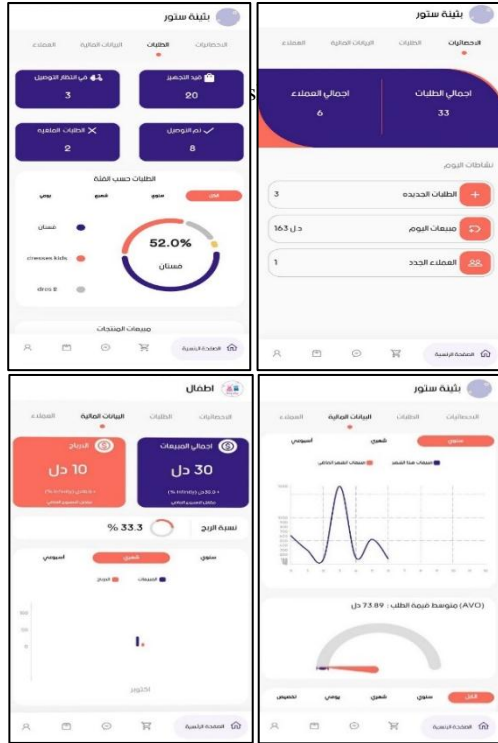


FIGURE 8. SURVEY RESPONSES

VI. CONCLUSIONS

This study applied ML techniques to develop a mobile e-commerce platform called STORY, in order to support the advancement of the Libya's online retail market. This platform seamlessly integrates numerous features, including multi-vendor functionalities and cutting-edge AI elements such as image search, background removal, recommendation systems, real-time chat, and comprehensive vendor analysis tools. Furthermore, the utilize of open-source technologies such as PHP, MySQL, Dart, Node.js, and Python not only underscores the application's robustness, but also emphasizes its commitment to simplicity, performance, and security.

Moreover, the evaluation using questionnaires highlighted its efficacy in enhancing user experiences and empowering vendors with data-driven insights.

For future research, this study suggests to add some features to increase the application performance and users' satisfaction such as:

- Implement a range of electronic payment options, including digital wallets, mobile payment systems, and additional emerging technologies, to offer users with diverse and secure methods to conduct in-app transactions.
- Develop an integrated delivery service program within the application framework and orders tracking to ensure efficient and reliable delivery experiences for purchased items.
- Develop a feature allowing users to seamlessly convert product images into interactive 3D models within the application.

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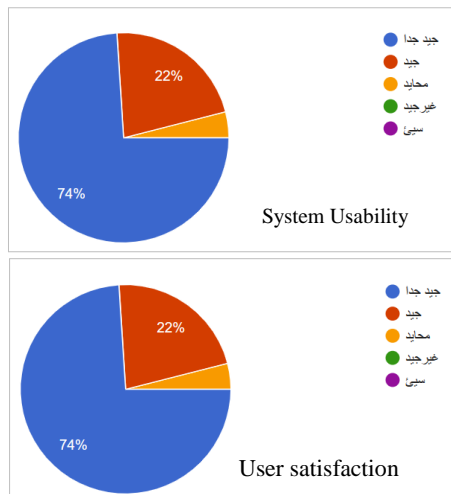
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The process begins with the collecting basic demographic data from the participants. Followed by questions evaluating ease of use. These questions are specifically designed to assess the ease of use, satisfaction, and system efficiency. They are tailored to provide insights into the user's perception of how user-friendly and convenient the software is in practical use.

The questionnaire concludes with an open-ended question, inviting participants to provide qualitative comments and express their thoughts using their own words. This qualitative data collection method gathers deeper insights into participants' experiences with the system.

The distribution strategy for collecting user feedback involved utilizing the Facebook platform within a dedicated group over a period of few days.

The questionnaire survey, drawing 20 responses, reflected a gender distribution of 33% male and 66% female. The user satisfaction resonated positively, with 38% expressing being "very satisfied" and 53% reporting as "satisfied" while a remaining 9% remained "neutral" Regarding usability, a substantial 70% rated it as "very good" with an additional 25% considering it "good". These figures indicate that a commendable user experience and high usability.



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