



E COMMERCE APPLICATION

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ABSTRACT—

The E-Commerce Application project represents a dynamic and innovative platform aimed at revolutionizing the digital marketplace landscape. In an era marked by the widespread adoption of online shopping and digital transactions, the demand for robust and userfriendly e-commerce solutions has never been higher. This project endeavours to meet this demand by offering a comprehensive and featurerich application designed to facilitate seamless buying and selling experiences for both consumers and merchants.

Key features of the E-Commerce Application include an extensive product catalogue, intuitive user interface, secure payment processing, and personalized shopping experiences. The application boasts a diverse range of products spanning various categories, catering to the diverse needs and preferences of consumers. Users can effortlessly browse through the catalogue, search for specific items, and access detailed product information, enabling informed purchasing decisions.

The user interface is thoughtfully designed to be intuitive and easy to navigate, ensuring a frictionless shopping experience for users across devices and platforms. Advanced search and filtering functionalities empower users to refine their product searches and discover relevant items efficiently. Additionally, personalized recommendations and curated collections enhance the shopping experience, offering tailored product suggestions based on user preferences and browsing history.

INTRODUCTION

Before the advent of e-commerce and the internet, consumers had to visit the traditional brick and mortar stores to purchase goods or services, and the sellers had to find a space where they could sell their products, but

due to the arrival of e-commerce and the internet some decades ago shoppers do not have to visit these stores to make a purchase, neither do the sellers have to find a place to locate their stores. In fact, buying and selling without any form of e-commerce is unthinkable, complicated and cumbersome to many these days /1/.

E-commerce, which is now an integral part of many businesses, is used primarily to boost sales revenue, to attract new customers and to survive in today's competitive business environment /2/. Also, it has benefitted the customers as they now have easy access to a wide range of goods and services at any time and anywhere in the world /3/.

Well-known examples of e-commerce companies are Amazon, eBay, and Zalando. E-commerce, also known as electronic commerce or e-business, is simply the buying and selling of goods and services via an electronic medium, mainly the internet. The usage of electronic commerce has been increasing rapidly in the last decades since its inception, prompting the majority of businesses to have an online platform. It is now essential for companies to do their business online, as virtually any kind of goods and services can be sold or purchased through the internet. /3/

1.1 OVERVIEW

An e-commerce application is a digital platform that enables businesses to sell products or services online. It includes features such as a product catalog, shopping cart, secure payment processing, order management, and customer accounts. E-commerce applications are designed to provide a seamless and secure shopping experience for customers, while also helping businesses manage their inventory, process orders efficiently, and track sales and customer behavior.



2. PROBLEM STATEMENT

The problem statement for an e-commerce application might be framed as follows:

"In a rapidly growing digital market, there is a need for an efficient and user-friendly e-commerce platform that caters to the increasing demand for online shopping. Existing e-commerce solutions often lack key features such as robust inventory management, secure payment processing, and personalized customer experiences. There is a need for an e-commerce application that not only addresses these issues but also provides analytics and reporting tools to help businesses make informed decisions and optimize their online sales strategies. The goal is to create a comprehensive e-commerce platform that meets the needs of both businesses and customers in the digital marketplace."

3. OBJECTIVES

The aim of this thesis is to develop an e-commerce Java web application for a small retail store, where the store owner (also called the administrator or admin) can sell goods over the internet. In the application, the admin will be able to manage products, customers, and orders, while the customers will be able to order and pay for products. The payment transaction will be carried out on PayPal testing environment (PayPal Sandbox). Also, the buyers will have the opportunity to subscribe to an email list in order to get announcements about new arrivals and sales promotions. Furthermore, there will be an email notification after completing an order or subscribing to an email list.

ANALYSIS AND REQUIREMENTS

Requirements analysis is one of the major tasks in software engineering, which is vital to the success of a software development project. It involves the determination of the requirements or functions of a software project /18/. The main task to perform before analyzing requirements is *requirements elicitation* /19/.

Requirements elicitation is the gathering of the requirements or needs of a software system from the client and other stakeholders involved in the software project. Some of the activities involved in requirements elicitation are interviews, meetings, and surveys. Three requirements elicitation techniques are Initiating the Process, Facilitated

Application Specification Techniques (FAST), and Quality Function Deployment (QFD). /19/

The requirements for this application were gathered based on QFD. This is because QFD prioritizes both explicit and implicit requirements for the software. Also, it focuses on client satisfaction all through the development process /20/.

Application Description

This application is divided into two parts – the home page and the admin page. The home page is where customers (buyers) can order and pay for products, and optionally administrative tasks. The admin page is restricted and can only be accessed through authentication provided by the Apache Tomcat servlet container. This means that all the web resources in the admin page can only be accessed by an authorized user.

Quality Function Deployment (QFD)

QFD is a requirements elicitation technique used to convert client's requirements and expectations into technical requirements for the software product. It aims at building a software system that fulfills client satisfaction by focusing on what is relevant to the client. More so, it utilizes different methods, such as interviews, surveys, and review of historical data to achieve its objectives. /19/

According to user needs and expectations, QFD prioritizes requirements into three types – they are:

- Normal requirements – These are must have requirements with priority level 1. They are requirements that fulfill client satisfaction if present. /19/
- Expected requirements – These are should have requirements with priority level 2. They are requirements that are not explicitly declared by the client but could be a reason for customer dissatisfaction if not accomplished. /19/



Exciting requirements – These are nice to have requirements with priority level 3. They are needs that are beyond the subscribe to an email list while the admin page is where the admin can carry outscope of the project but could result in client satisfaction when present. /19/

The requirements for this application as prioritized according to QFD are shown in Table 1.

Table 1. Requirements prioritized according to QFD.

Normal Requirements
[1]The home page of the application should display available products whose quantity is not less than one.
[2]Customers should be able to add products to a shopping cart.
[3]Customers should be able to view products in the shopping cart.
[4]Customers should be able to update product quantity in the cart.
[5]Customers should be able to remove any product from the cart.
[6]Customer should be able to empty all the products in the cart.
[7]Customers should have an option to subscribe to an email list.
[8]Customers should be able to checkout through PayPal Express Checkout payment solution on Paypal Sandbox.
[9]Customers should be able to view order confirmation after a successful order completion.
[10] The admin should be authenticated in order to have access to the admin page of the application to perform any administrative task.
[11] The admin should be able to manage (add, update and delete) products and their categories.
[12] The admin should be able to view the lists of products and categories.
[13] The admin should be able to view the email subscribers' list.
[14] The admin should be able to view payment and order details.
[15] The admin should be able to update order status.
[16] The application should save all customer, product, order, payment and admin data on MySQL database.
Expected Requirements
1. The application should display a friendly error message after a failed login by the admin.
2. The application should display a friendly error message after a failed or canceled payment process.
3. The application should implement interactive graphical user interfaces (GUI).
4. An email confirmation should be sent to customers who subscribe to the email list.
5. An email confirmation should be sent to customers after a successful order completion.
6. The admin should be able to download email subscribers' list, payments and orders reports in MS excel format.
Exciting Requirements
1. The application should implement other payment methods, such as debit/credit card and google checkout.
2. The application should also be available on mobile devices.

Analysis Models

Modeling involves the designing of software systems before coding takes place. Modeling plays an important role in any software development project. It guarantees the completeness and correctness of a software system and the fulfillment of end-users’ expectations. In addition, modeling serves as the only reference point to cross-check requirements before coding. /19/

A Unified Modeling Language (UML) based tool was used to model this application. UML diagrams give both static and dynamic views of an application and it is well suited for object-oriented languages like Java and C# /19/. The following sub-sections present the UML diagrams used to model this application.

Use Case Diagram

The use case diagrams for this application illustrate the interactions that exist between users (actors) and use cases (actions) within the application. There are two actors identified for this application – administrator (admin) and customer actors. As a result, there are two use case diagrams for the software application – admin use case diagram and customer use case diagram. The admin is the owner of the ecommerce store who performs various administrative tasks such as add products, view orders, and update order status while the customer is any individual who buys a product or products from the online store.

Figure 2 shows the admin use case diagram. The diagram depicts how the admin communicates with the application. More so, it shows all the actions that the admin can perform on the application. As can be seen in the diagram, before any of these actions could be executed the admin will have to login in order to be authenticated.

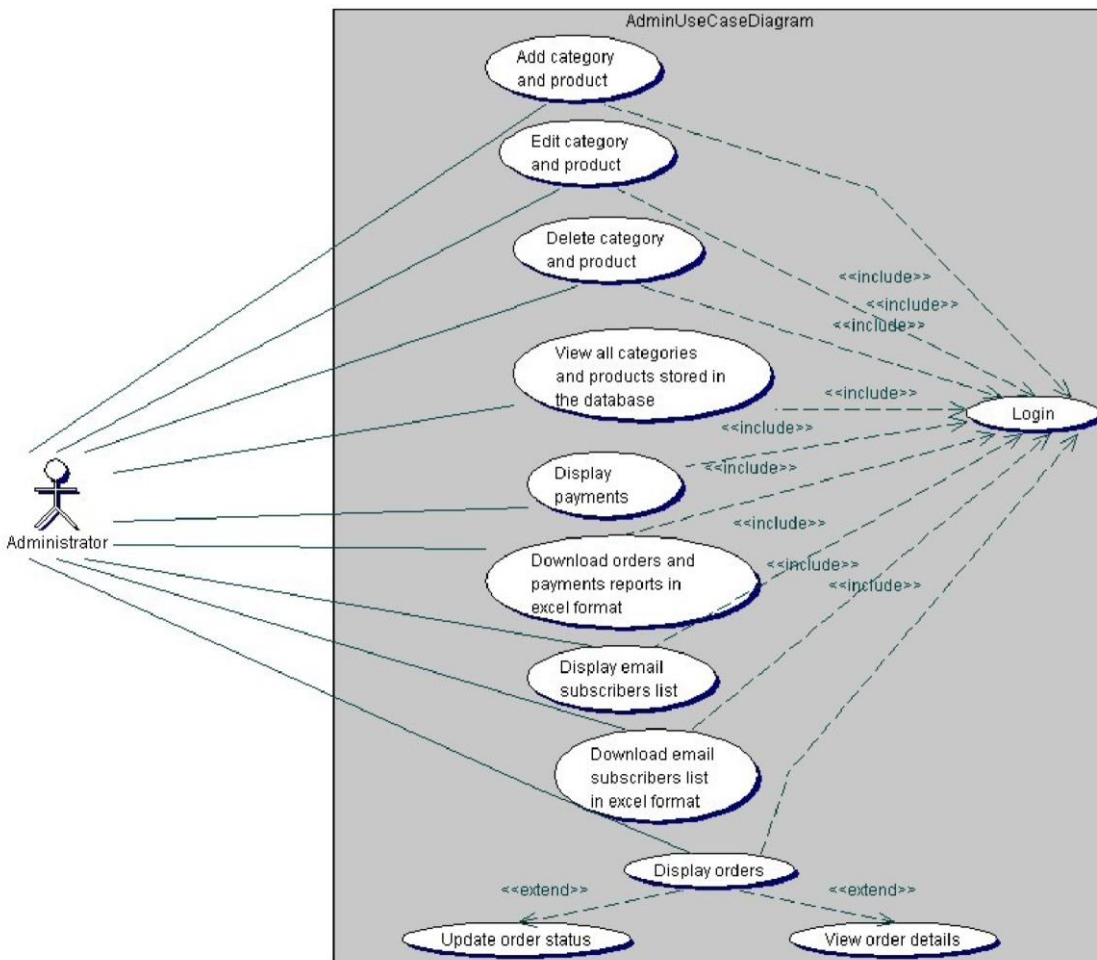
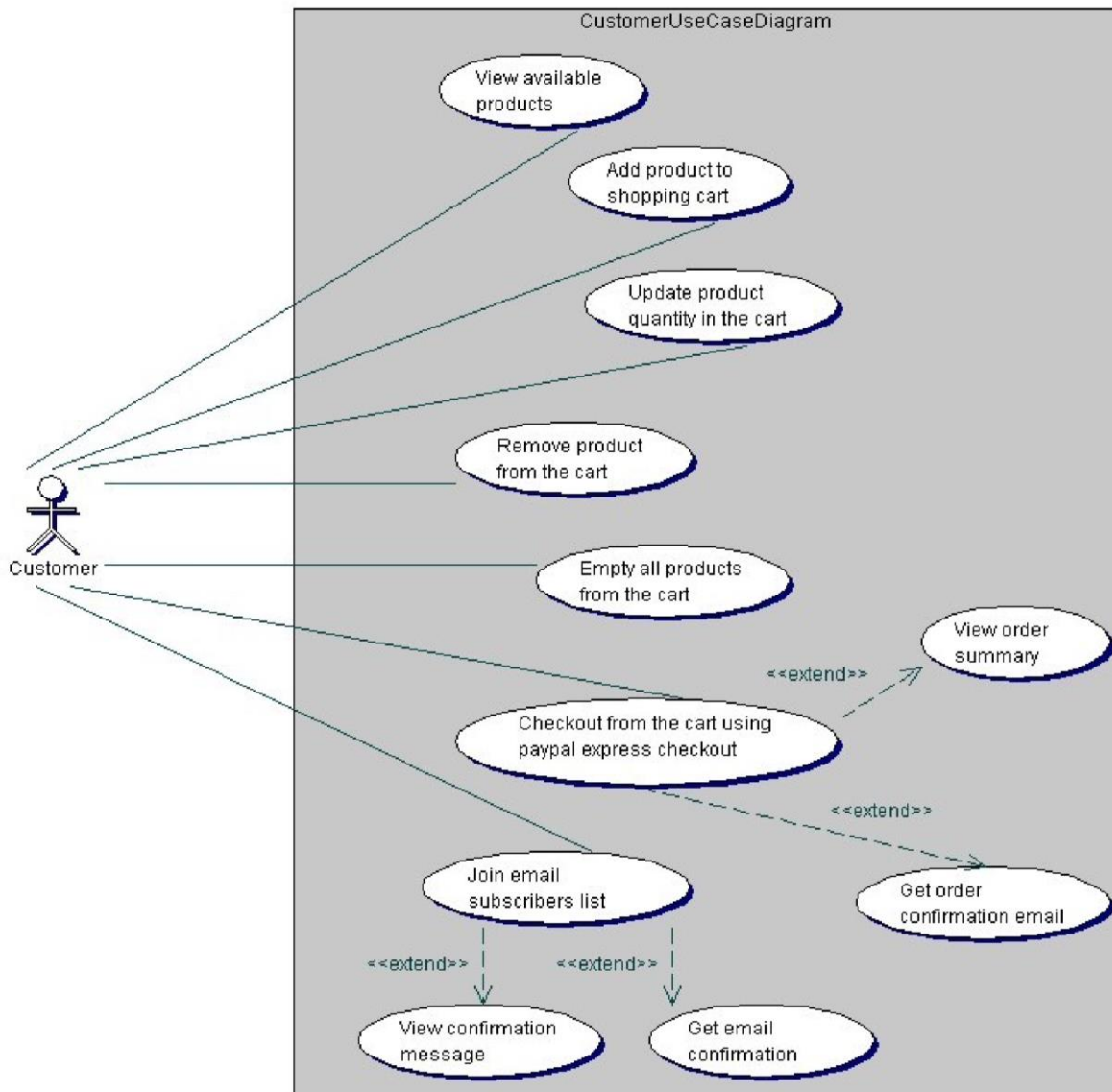


Figure 2. Admin use case diagram.

Figure 3 shows the customer use case diagram. It describes the different use cases that can be executed by the customer on the e-commerce application. For the checkout process using PayPal Express Checkout, the buyer will have to be authenticated on a secured PayPal website.

4. CONCLUSION

The main objective of this thesis work was to develop an ecommerce Java web application for a small retail store where the store owner manages products, customers, and orders, while the customers make orders and pay for products. The application was developed with the above-mentioned features. One of the biggest challenges faced during the development of this software project was how to implement JPA for the application. A lot of time and effort were invested in learning and implementing



JPA for this e-commerce application. Another challenge faced was how to integrate PayPal Express Checkout NVP API operations for the project. PayPal has a poor API integration documentation, especially API integration for the Java programming language. This actually affected the flow of the application development process as much time was used to learn and understand the NVP API integration for Java. With these challenges and others not mentioned here, a lot of new experience has been gained during the development process of this application.



Although all the requirements set out for the e-commerce web application have been met, there are still areas to improve on. A mobile version can be developed for the application so that users can have a better access to the application. Also, other online payment methods like credit/debit card and bank payment methods can be implemented for the application.

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