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TOPIC:

"Conception et Implémentation d'une Plateforme de Commerce Électronique : Développement d'un Site Web E-commerce"

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We extend our heartfelt gratitude to all those who have contributed to the completion of this thesis on the development of an e-commerce website.

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Abstract

An Algerian electronic mall that brings together sellers, “store owners” and buyers, where the user can create his store and modify the appearance of the store: The first version controls the color of the store only. It allows ordinary users to see the products present on the site and propose to it, specializing in ease of use, cash transactions, and transportation. The project uses reinforcement-learning algorithm to display proposed products according to the user’s interests. The thesis focuses on the design and development of the platform, in addition to usability and user satisfaction. This thesis also provides valuable insights into the effectiveness of such platforms in promoting trade, we are currently working on the mobile app for the platform, which we aim to make the largest platform for Algerian e-commerce.

This project also aims to exploit and implement the knowledge and skills acquired during our training, as well as self-training and improving the concepts of teamwork, coordination, and management necessary to enter the world of professionalism.

Keywords:

Store, web, Algerian e-commerce, JavaScript, sellers, Mongo DB, platform.

ملخص

مول إلكتروني جزائري يجمع بين البائعين و "أصحاب المتاجر" والمشترين، حيث يمكن للمستخدم إنشاء متجره الخاص وتعديل مظهر المتجر: النسخة الأولى تتحكم في لون المتجر فقط. يتيح للمستخدمين العاديين رؤية المنتجات الموجودة على الموقع والمقترحة عليه، ويتخصص في سهولة الاستخدام والمعاملات النقدية والنقل. يستخدم المشروع خوارزميات التعلم المعزز لعرض المنتجات المقترحة وفقًا لرغبات المستخدم. وتركز الدراسة على تصميم المنصة وتطويرها، بالإضافة إلى سهولة الاستخدام ورضا المستخدم. كما توفر هذه الدراسة رؤى قيمة حول فعالية مثل هذه المنصات في تعزيز التجارة، ونحن نعمل حاليًا على تطبيق الهاتف المحمول الخاص بالمنصة والتي نهدف إلى جعلها أكبر منصة للتجارة الإلكترونية الجزائرية.

ويهدف هذا المشروع أيضًا إلى استغلال وتنفيذ المعرفة والمهارات المكتسبة خلال تدريبنا، وكذلك التدريب الذاتي وتحسين مفاهيم العمل الجماعي والتنسيق والإدارة اللازمة لدخول عالم الاحتراف.

الكلمات المفتاحية:

متجر، ويب، تجارة إلكترونية جزائرية، جافا سكريبت، بائعون، db mongo، منصة.

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General Introduction

Introduction

In recent years, the landscape of commerce has undergone a profound transformation with the advent of e-commerce platforms, revolutionizing the way businesses engage with customers and conduct transactions. The proliferation of digital technologies has not only facilitated the global expansion of markets but has also provided opportunities for entrepreneurs and small businesses to thrive in the digital economy.

In the context of Algeria, a country with a rich cultural heritage and a burgeoning entrepreneurial spirit, there exists a need for innovative solutions to catalyze economic growth and empower local businesses. Recognizing this imperative, our project endeavors to create an Algerian electronic mall—a dynamic online marketplace that brings together sellers, storeowners, and buyers in a single platform, which we chose to name: the Algerian online store (AOS).

1.1 Problem Statement

The Algerian e-commerce market lacks a user-friendly and comprehensive online platform, hindering economic growth and innovation. Existing platforms fail to adequately support local businesses and meet the diverse needs of consumers. To address these challenges, there is a pressing need to develop the Algerian Online Store (AOS), an innovative e-commerce platform designed to empower local businesses, enhance user

experience, and drive economic prosperity. This memo aims to propose the development of AOS as a solution to the shortcomings of the current e-commerce landscape in Algeria.

1.2 Objectives

Our primary goal is to provide a digital storefront for Algerian entrepreneurs to showcase their products and services. This initiative aims to democratize market access and foster a culture of entrepreneurship and innovation.

Central to our project is a commitment to user-centric design and technological innovation. By integrating advanced technologies such as reinforcement learning algorithms, we aim to personalize the shopping experience for our users.

Additionally, our project has two key objectives: to apply and leverage the knowledge and skills we have acquired during our training, and to foster a culture of professionalism, teamwork, and leadership.

As aspiring professionals in computer science and technology, we view this project as an opportunity not only to demonstrate our technical abilities but also to develop our interpersonal skills and project management capabilities.

In the following sections of this report, we will delve deeper into the design and development of the Algerian electronic mall. We will begin with a preliminary study of our project, discuss the construction stages, and conclude with our findings and perspectives for the future.

Chapter 1 State of the Art

Introduction

This chapter consists of three sections. The first part will be devoted to an overview of the concept of e-commerce, the concept of e-shopping centers, and the advantages and disadvantages of the e-mall. The second section presents an overview of reinforcement learning and its uses in commerce platforms. The third section deals with the definition of requirements according to RFC 2119, and based on a conducted comparison, we have defined a set of functions and quality requirements according to ISO 25000 for our platform.

1.1 What is E-Commerce?

E-commerce (electronic commerce) is the buying and selling of goods and services, or the transmitting of funds or data, over an electronic network, primarily the Internet. These e-commerce transactions typically fall within four types: business-to-business (B2B[1]), business-to-consumer (B2C)[2], consumer-to-consumer, or consumer-to-business.

[1] https://www.techtarget.com/searchcustomerexperience/definition/B2B
[2] https://www.techtarget.com/searchcustomerexperience/definition/B2C

The terms e-commerce and e-business are often used interchangeably. The term e-tail is also sometimes used in reference to the transactional processes[3] that make up online retail shopping.

In the last two decades, e-commerce platforms -- such as Amazon and eBay -- have contributed to substantial growth in online retail. In 2011, e-commerce accounted for 5% of total retail sales according to the U.S. Census Bureau. By Q2 2020, after the start of the COVID-19 pandemic, e-commerce accounted for 16.5% of retail sales. Since then, it has fallen slightly to about 15% as physical stores reopened.[1]

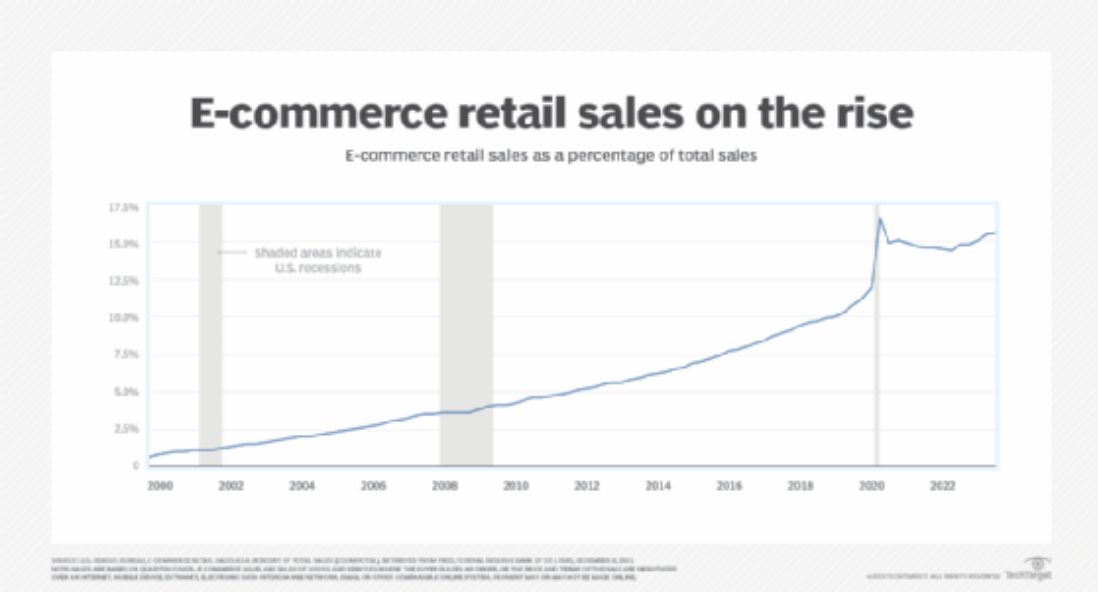


Figure 1: Line graph showing the rise of e-commerce from 2000 to 2023

1.1.1 Concept of E-Malls

E-Malls also known as Electronic Malls or Online Malls are like normal shopping malls but they function online in the form of a website or app. Like a normal shopping mall has many shops and brands present inside it, similarly, an E-Mall website or app has numerous brands and suppliers a charge commission from these brands and suppliers depending upon the number of sales they do.

[3] https://www.techtarget.com/searchcio/definition/transaction

In simple words, we can call an E-Mall, an online shopping center with a collection of multiple online shops on a single platform. All the transactions from selecting the goods to buying and selling of goods and services take place with the help of the Internet. E-Mall is a concept of E-Commerce and is one of the most trending and profitable forms of business. The retailers who have their brands and stores on these E-Mall platforms are known as E-Tailers.[2]

There are basically four types of E-Mall stores: -

- **General E-Malls:** These general E-Malls are like general stores they do not specialize in any specific goods or service.[2]

- **Specialized E-Malls:** These E-Malls specialize in specific goods or services and sell only that product.[2]
- **Regional E-Malls:** General E-Malls are basically on a global platform they are not a part of any local region or area. But Regional E-Malls function based on a local or regional area. Their sales happen in that area, their marketing is done in that area and their target is a part of that area.[2]
- **Pure online stores:** These E-Malls are purely online stores meaning that products that you find on these platforms cannot be found anywhere else in any shopping mall or shop.[2]

  - So, after these definitions, we classified our electronic mall as a regional e-shopping center because its sales are made in the Algerian region, we also seek to make it a global platform such as Amazon.

1.1.2 Advantages and Disadvantages of E-Mall

E-commerce offers advantages to consumers and there are some disadvantages that come with e-commerce websites as well. They are as follows:

Table 1 : advantages and disadvantages of E-mall.[3]

Pros	Cons
• Owners can generate revenue semi-passively • Consumers can easily browse for specific products • Greater earning potential as there are no limitations on physical location as long you can ship there • Reduced costs assuming digital presence costs less than building, insurance, taxes, and repairs. • Greater marketing control, including data extraction from customers, targeted ads, and pop-up placement	• Limited customer service opportunities as there are little to no face-to-face opportunities. • Lacks instant gratification as customers must believe in a product before seeing it in person • Products cannot be seen or handled until delivered (cannot try before they buy) • Loss of revenue or income when websites go down • High reliance on shipping constraints. • Higher competition due to lower barriers of entry and greater customer potential.

1.2 What is Reinforcement Learning?

Reinforcement learning (RL) is a machine learning (ML) technique that trains software to make decisions to achieve the most optimal results. It mimics the trial-and-error learning process that humans use to achieve their goals. Software actions that work towards your goal are reinforced, while actions that detract from the goal are ignored[4].

RL algorithms use a reward-and-punishment paradigm as they process data. They learn from the feedback of each action and self-discover the best processing paths to achieve final outcomes. The algorithms are also capable of delayed gratification. The best overall strategy may require short-term sacrifices, so the best approach they discover may include some punishments or backtracking along the way. RL is a powerful method to help artificial intelligence (AI) systems achieve optimal outcomes in unseen environments[4].

1.2.1 What are the Use Cases of Reinforcement Learning?

Reinforcement learning RL can be applied to a wide range of real-world use cases. We give an example of a use case that applies to our project, in applications like recommendation systems, RL can customize suggestions to individual users based on their interactions. This leads to more personalized experiences. For example, an application may display ads to a user based on some demographic information. With each ad interaction, the application learns which ads to display to the user to optimize product sales.[4]

1.2.2 How does Reinforcement Learning Work?

The learning process of reinforcement learning (RL) algorithms is similar to animal and human reinforcement learning in the field of behavioral psychology. For instance, a child may discover that they receive parental praise when they help a sibling or clean but receive negative reactions when they throw toys or yell. Soon, the child learns which combination of activities results in the end reward. [4]

An RL algorithm mimics a similar learning process. It tries different activities to learn the associated negative and positive values to achieve the end reward outcome.

Key concepts:

In reinforcement learning, there are a few key concepts to familiarize yourself with:

- **The agent** is the ML algorithm (or the autonomous system).
- **The environment** is the adaptive problem space with attributes such as variables, boundary values, rules, and valid actions.
- **The action** is a step that the RL agent takes to navigate the environment.
- **The state** is the environment at a given point in time.
- **The reward** is the positive, negative, or zero value—in other words, the reward or punishment—for taking an action.
- **The cumulative reward** is the sum of all rewards or the end value.

Algorithm basics

Reinforcement learning is based on the Markov decision process, a mathematical modeling of decision-making that uses discrete time steps. At every step, the agent takes a new action that results in a new environment state. Similarly, the current state is attributed to the sequence of previous actions.

Through trial and error in moving through the environment, the agent builds a set of if-then rules or policies. The policies help it decide which action to take next for optimal cumulative reward. The agent must also choose between further environment exploration to learn new state-action rewards or select known high-reward actions from a given state. This is called the *exploration-exploitation trade-off*.[4]

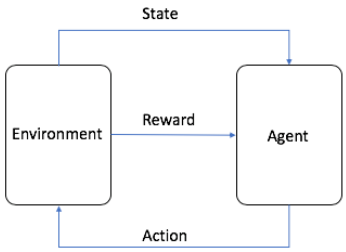


Figure 2: RL Algorithme

1.3 Definition of Requirements

Defining clear and comprehensive requirements is essential to ensure the success of any project, as it directs the design, development, and implementation processes. In this section, we conducted a small study to define the requirements for our platform, focusing on the specific needs, functions, and quality standards that our platform must adhere to.

1.3.1 Comparative Analysis of Similar Platforms

As part of our analysis, we compare key features and functionalities among three prominent platforms in the Algerian e-commerce landscape: the Algerian Online Store (AOS), Swiga app, and Ouedkniss Site, this comparison aims to provide insight into the

strengths, advantages, and weaknesses of each. Platform and guide us on the requirements to develop a high-quality platform that satisfies customers:

Table 2: Comparative analysis between our platform (AOS) and similar websites.

Aspect	**AOS platform (our platform)**	**Swiga App**	**Ouedkniss Site**
User Interface and User Experience	✓ Clean and intuitive UI, visually appealing design.	✗ Minimalist Ui, may lack intuitive navigation	✗ Cluttered Ui, an overwhelming amount of information.
Product Variety And Selection	✓ Diverse range of products from local sellers and services.	✗ Limited selection	✓ Wide range of products and services
Mobile Accessibility	✓ Responsive design, dedicated mobile apps for Android and iOS		
Customer Support	✓ Robust customer support channels,	✗	✗
Feedback Mechanism	✓ Incorporation of user feedback mechanisms such as ratings reviews and surveys.	✗ Limited options for users to provide feedback.	✗ Feedback from users may not be adequately addressed or implemented.
Integration with Third-party services	✓ Integration with third-party services such as payment gateways and shipping providers.	✗ Limited integration with external services.	✓

1.3.2 Functional Requirements

A set of functions and characteristics that will distinguish our application, which we arrived at after conducting research and study, as well as after conducting a comparative analysis between our platform (AOS) and similar sites.

1. The app must allow sellers to create and manage their profiles, including product listings, pricing, and availability.

2. The app should enable buyers to search for products based on categories, keywords, seller ratings, and location.

3. The app must allow buyers to view detailed product descriptions, images, and seller information before making a purchase.

4. The app should provide secure payment options, including credit/debit cards, mobile wallets, and cash on delivery.

5. The app must facilitate communication between buyers and sellers through a messaging system for inquiries, negotiations, and order updates.

6. The app should offer features for tracking order status, delivery updates, and providing feedback on the buying experience.

7. The app must allow sellers to track sales, manage inventory, and analyze performance through comprehensive dashboard tools.

1.3.3 Software Quality Specification (ISO 25010)

ISO 25010 defines a set of quality characteristics that software products must exhibit to meet user needs and expectations.

The quality model is the cornerstone of a product quality evaluation system. The quality model determines which quality characteristics will be taken into account when evaluating the properties of a software product.[5]

The quality of a system is the degree to which the system satisfies the stated and implied needs of its various stakeholders and thus provides value. Those stakeholders' needs (functionality, performance, security, maintainability, etc.) are precisely what is represented in the quality model, which categorizes the product quality into characteristics and sub-characteristics.[5]

Table 3: ISO 25010 quality characteristics

Aspect	**Description**
Usability	AOS aims to provide a user-friendly interface and intuitive navigation to enhance usability. This includes features such as clear product categorization, an easy checkout process, and personalized recommendations to improve user experience.
Reliability	AOS ensures reliability by maintaining consistent uptime and performance. This involves robust server infrastructure, regular maintenance, and monitoring to prevent system failures or disruptions to user access.
Performance Efficiency	AOS optimizes performance efficiency by minimizing page load times, reducing server response times, and optimizing resource usage. This ensures a smooth and responsive browsing experience for users, even during periods of high traffic.
Security	AOS prioritizes security to protect user data, transactions, and privacy. This includes encryption of sensitive information, secure authentication mechanisms, and regular security audits to detect and address vulnerabilities.

Compatibility	AOS is designed to be compatible with a wide range of devices and browsers to ensure accessibility for all users. This involves responsive web design, cross-browser compatibility testing, and compatibility with mobile devices.
Maintainability	AOS is built with maintainability in mind, allowing for easy updates, bug fixes, and enhancements. This includes modular code architecture, version control systems, and documentation to facilitate ongoing maintenance and development.
Portability	AOS aims to be portable across different platforms and environments. This involves using technologies and frameworks that support cross-platform development, as well as ensuring compatibility with various operating systems and devices.

Chapter 2 Design and Implementation

2.1 Introduction

This chapter consists of two sections. The first section will be devoted to a conceptual study where we will use design formalism, namely UML, a graphical modeling language that will allow us to understand and describe the needs to define and document systems, as well as to draw software architectures. The second section presents implementation, where we will discuss the languages used in developing our platform, collaborative tools, etc.

2.2 Conceptual Study

In this part, we establish a conceptual model for our solution using a method of UML design.

2.2.1 Use Case Diagram

Use Case Diagrams are used to depict the functionality of a system or a part of a system. They are widely used to illustrate the functional requirements of the system and its interaction with external agents(actors).[6]

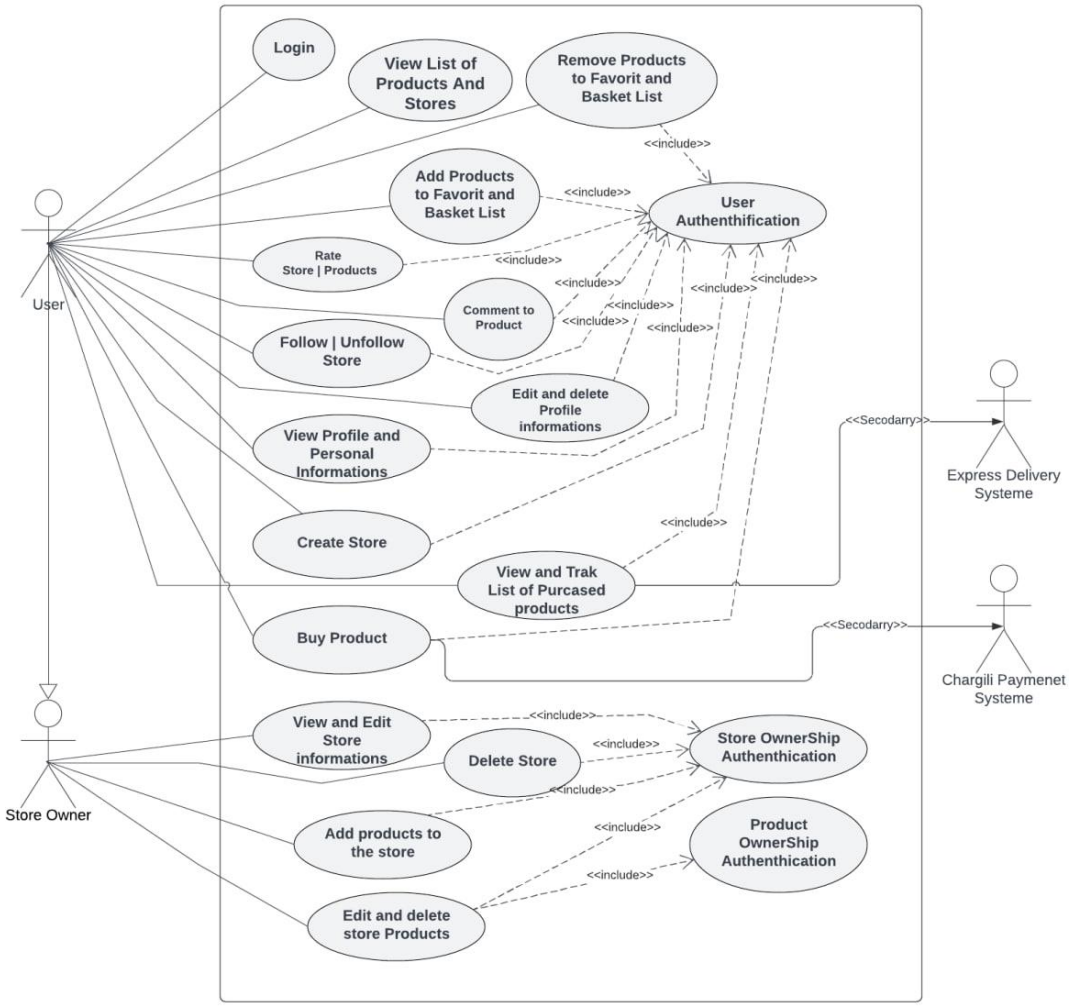


Figure 3: Representation of Use case diagram

2.2.2 Login Sequence diagram

A sequence diagram simply depicts interaction between objects in a sequential order i.e. the order in which these interactions take place[6].

Secure Login and Authentication

Introduction: In our web application, ensuring secure user authentication is fundamental to protect user accounts and sensitive information. Let us walk through a scenario illustrating how a user securely logs into our platform.

Scenario: Meet Alex, an avid shopper who frequently visits our e-commerce website to explore the latest products and make purchases.

1. **Initiating the Login Process:**
    - Alex opens his web browser and navigates to our website's login page.
    - He enters his registered email address and password in the designated fields.
    - With a click of the "Login" button, Alex submits his credentials to access his account.
2. **Server-side Authentication:**
    - Upon submission, the server receives Alex's login request.
    - It immediately validates the input to ensure both the email and password fields are populated.
    - Additionally, the server verifies that Alex's password meets the minimum length requirement and that his email follows a valid format.
3. **Database Interaction:**
    - Once the input is validated, the server queries the database to find a user matching Alex's email address.
4. **Password Verification:**
    - If a user with Alex's email is found, the server compares the password provided by Alex with the hashed password stored in the database.
    - If the passwords match, the server proceeds with the authentication process.
5. **Token Generation and Cookie Creation:**
    - Upon successful authentication, the server generates two essential tokens: an access token and a refresh token, using JSON Web Tokens (JWTs).
    - The access token contains Alex's user ID and is set to expire after a designated period, typically one hour.
    - The refresh token, with a longer expiration period, also contains Alex's user ID.
6. **Secure Transmission and Storage:**
    - The refresh token is securely stored in the database, associated with Alex's user ID.

- Both the access token and refresh token are transmitted securely to Alex's browser as HTTP cookies.
- These cookies are configured as HTTP-only and are restricted to secure connections, enhancing security against common attacks like cross-site scripting (XSS) and cross-site request forgery (CSRF).

7. **User Experience and Redirection:**
   - Alex's browser receives the authentication response from the server, indicating successful login.
   - He is seamlessly redirected to his personalized dashboard or the landing page, where he can explore products and manage his account.
8. **Error Handling and Security Measures:**
   - In case of incorrect credentials or unexpected errors during the authentication process, the server provides appropriate error messages to guide Alex.

Conclusion: Through this secure authentication process, Alex can confidently access his account, browse products, and engage with our platform while we prioritize the confidentiality and integrity of his data.

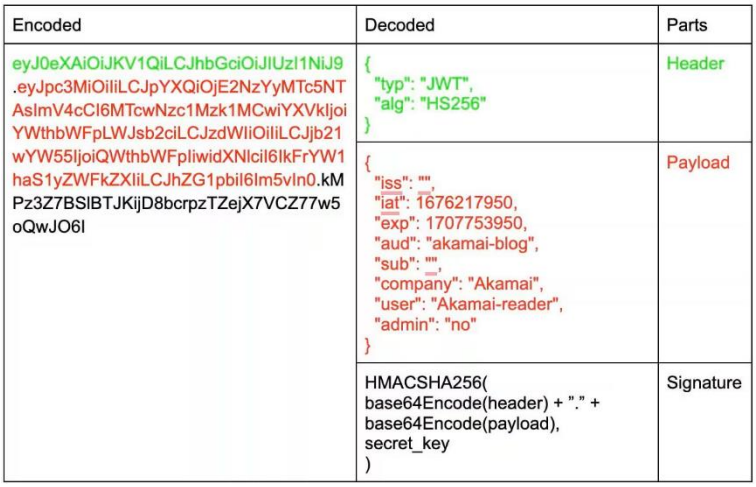


Figure 4: Example of Jwt Code

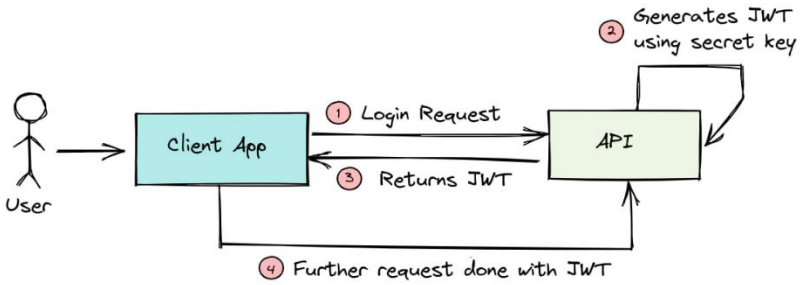


Figure 5: Explanation of the Work of Jwt

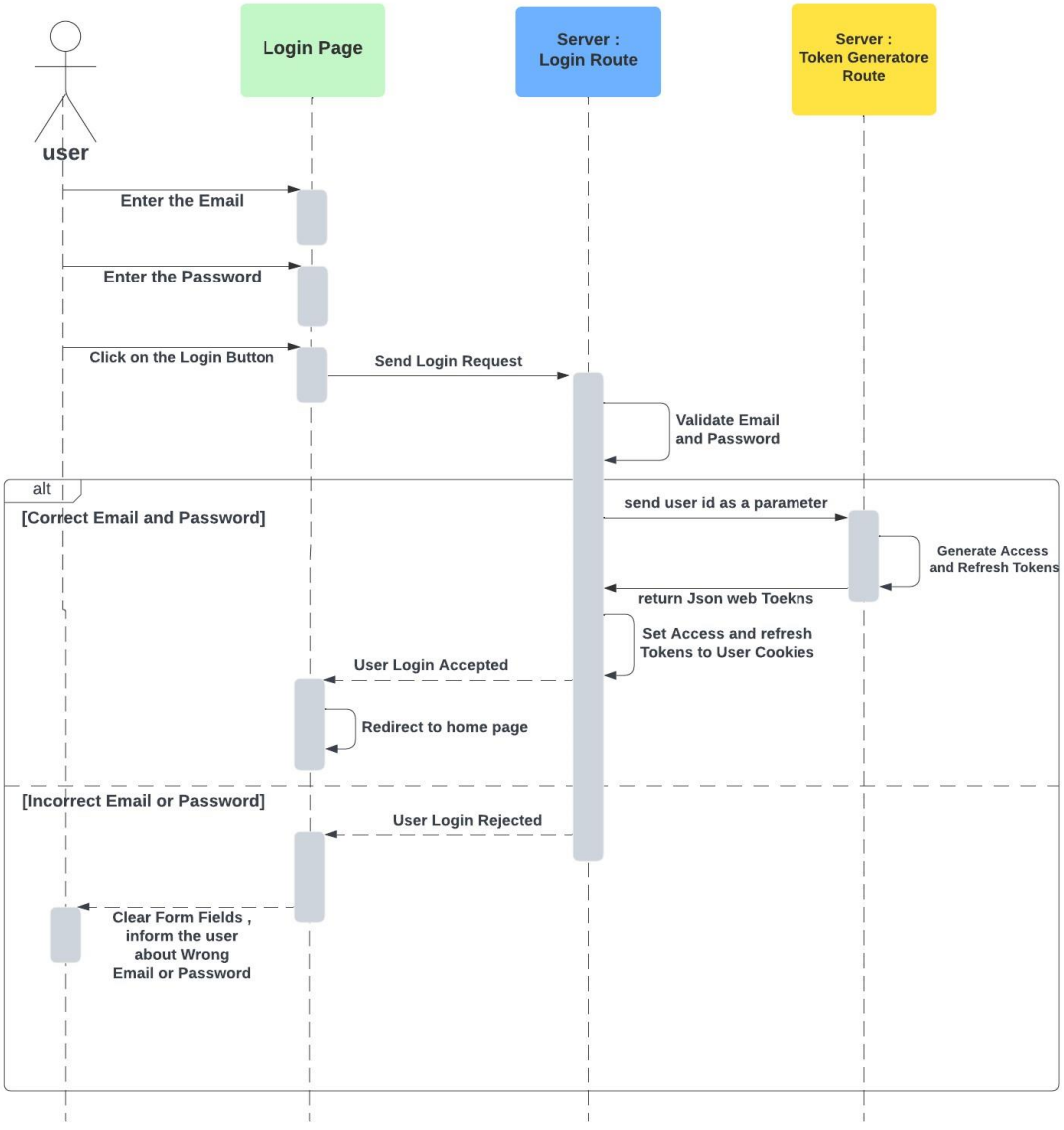


Figure 6: Representation of Sequence Diagram for Login

2.2.3 Register and Activate the Account State Transition Diagram

To register and activate an account, the user navigates to the Register page, where they fill out the required form fields and click on the submit button. Upon submission, the server validates the input data, ensuring no errors occur during registration. Possible errors may include an email already existing in the system or incorrect fields. If registration is successful, the account is created. Subsequently, the user is directed to the verification page, where they are prompted to enter the verification code sent to their email address. If the user enters an incorrect code, an error is triggered, indicating an unsuccessful verification attempt. However, upon entering the correct verification code, the account is successfully verified, allowing the user to access the platform's features.

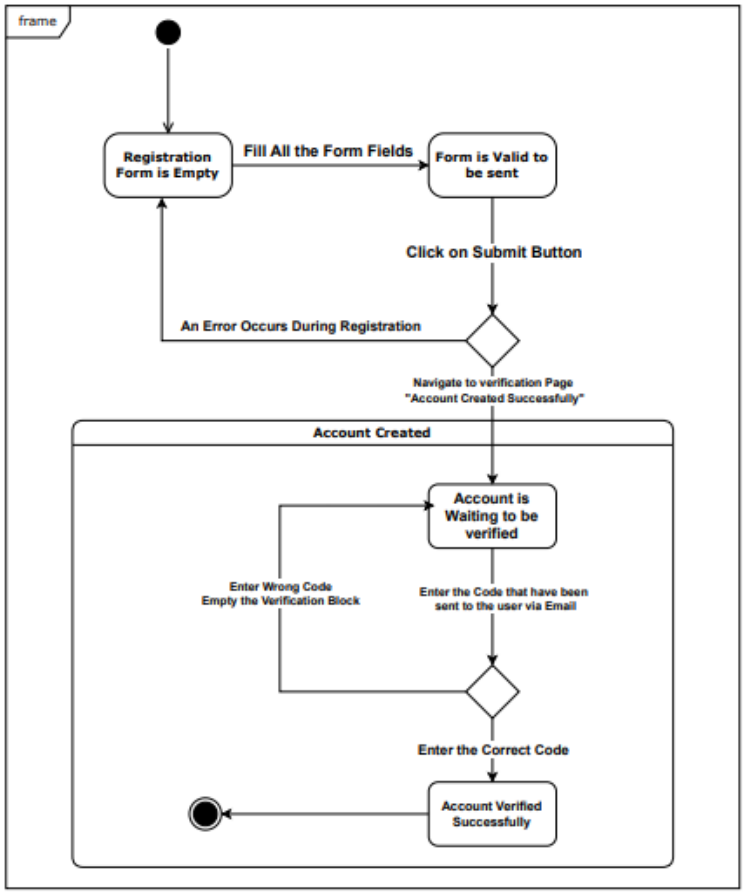


Figure 7: Representation of state transition diagram

2.2.4 Delete User Profile Activity Diagram

Deleting User Profile

In our platform, users have the ability to delete their profiles permanently. This functionality ensures that users have control over their personal data and can opt-out of the platform if desired.

Scenario: Sarah, a user of our platform, has decided to delete her profile due to personal reasons.

1. **Initiating Profile Deletion:**
    - Sarah navigates to the account settings page, where she finds the option to delete her profile.
    - She clicks on the "Delete Account" button to initiate the deletion process.
2. **Authentication and Authorization:**
    - Before proceeding with the deletion, the server verifies Sarah's identity to ensure she has the necessary permissions.
    - Sarah's authentication token is validated, and if successful, she is authorized to delete her profile.
3. **Deleting Profile Data:**
    - Upon successful authentication and authorization, the server begins the process of deleting Sarah's profile data.
    - The server first retrieves Sarah's user ID to locate her profile in the database.
4. **Removing Associated Data:**
    - Sarah's profile data, including her personal information, stored files (such as profile pictures), and associated records (e.g., user actions), are permanently removed from the database.
    - Additionally, any stores or products owned by Sarah are deleted to ensure data consistency.
5. **Revoking Access Tokens:**
    - Any existing access and refresh tokens associated with Sarah's account are invalidated to prevent unauthorized access after profile deletion.

- The server clears Sarah's cookies, ensuring that any remaining session data is removed from her browser.

6. **Confirmation Message:**
    - Once the deletion process is complete, the server sends a confirmation message to Sarah, indicating that her profile has been deleted successfully.
7. **Conclusion:**
    - Sarah receives the confirmation message and acknowledges that her profile has been permanently deleted from the platform.
    - She can no longer access her account or any associated data, ensuring her privacy and data protection rights are upheld.

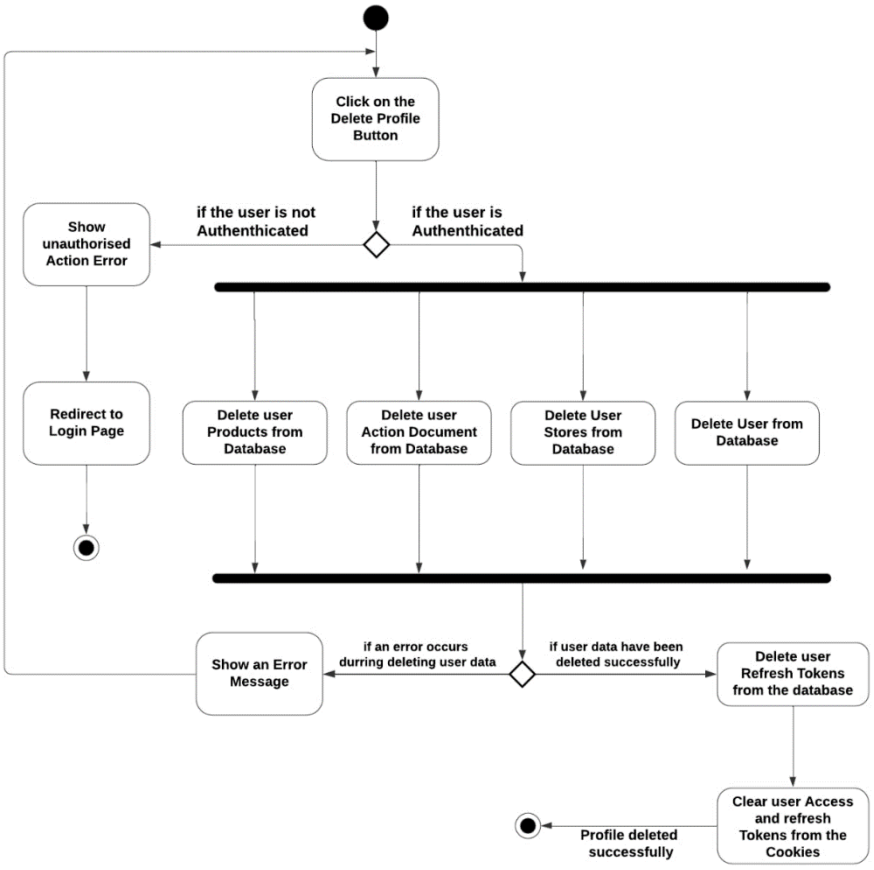


Figure 8: Delete User Profile Activity Diagram

2.2.5 Representation of Database

It is a representation of all the data used in the information system.

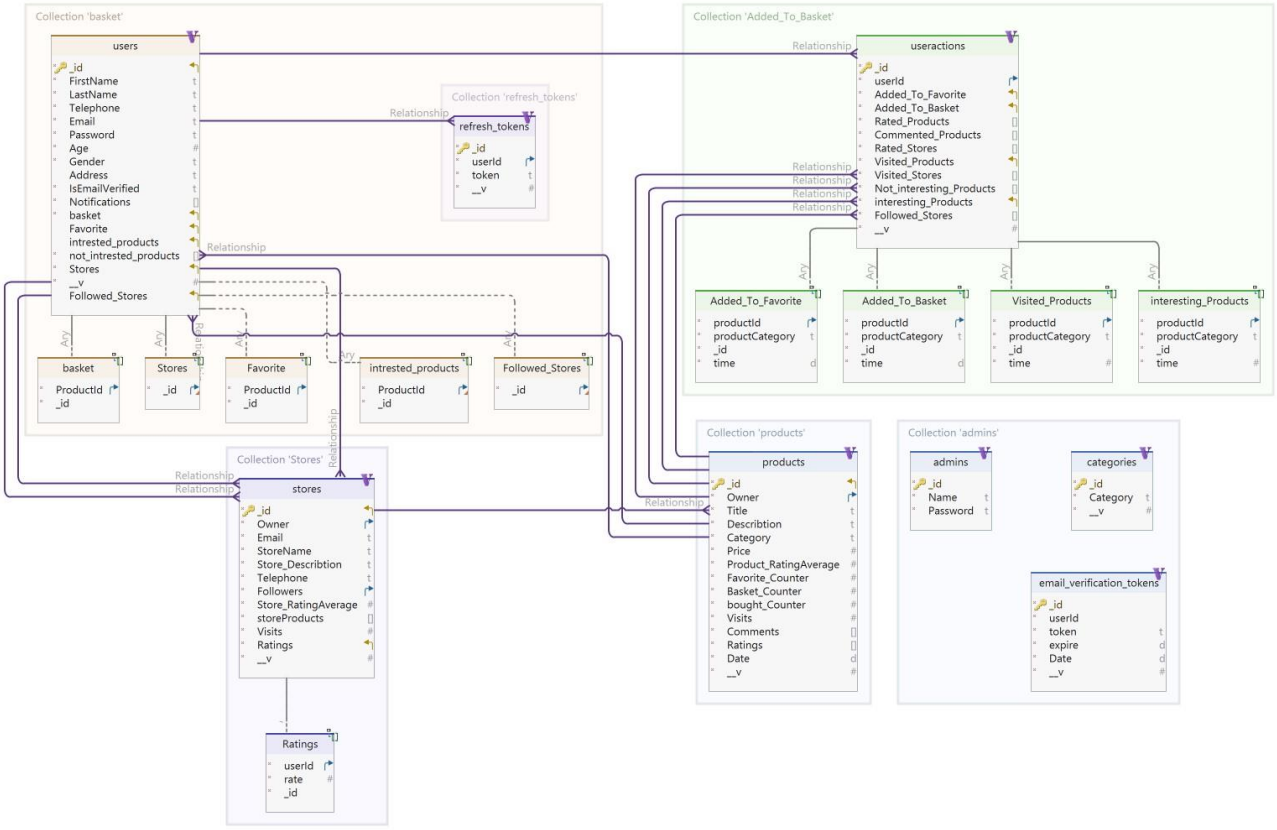


Figure 9: Representation of the database

2.3 Implementation

At this point in the process of building our app, the use cases are complete, the problem has been analyzed in depth, We have selected the design that we hope will be the most popular Suitable. In this chapter, we will present the ergonomics The technologies and programming languages we used:

2.3.1 Tools

1. **IDE VS Code:** It is an IDE from Microsoft and is used to develop websites, web apps, and mobile apps. It has a wide functioning which allows it to develop almost anything. It also supports IntelliSense coding for C++. It can be used in both Windows and MAC and allows us to create applications for any platform. It enables us to test apps and correct errors on the go. Visual Studio is available for free. Visual Studio comes with its own search engine which allows to search for the features of Visual Studio. The Team Foundation Server feature of Visual Studio is also very nice, it allows the user to have a checkpoint and roll back to the previous version. But the problem with Visual Studio is that it is a heavy software and takes a very long time to load.[7]

Figure 10: VS Code logo

2. **Figma:** Figma is a free, collaborative, web-based designing tool that is used by various personalities like designers, product managers, and developers to create wireframes, prototypes, or aesthetic designs. It provides easy-to-use components for sketching the graphics on its workspace. This tool is available on

all types of platforms and one can share their work with others by using the direct feature in the tool without having to export it manually.[8]

Figure 10: Figma Logo

3. **GitHub:** GitHub is a web-based interface that uses Git, the open source version control software that lets multiple people make separate changes to web pages at the same time. As Carpenter notes, because it allows for real-time collaboration, GitHub encourages teams to work together to build and edit their site content[9].

GitHub allows multiple developers to work on a single project at the same time, reduces the risk of duplicative or conflicting work, and can help decrease production time. With GitHub, developers can build code, track changes, and innovate solutions to problems that might arise during the site development process simultaneously. Non-developers can also use it to create, edit, and update website content, which Carpenter demonstrates in her tutorial.[9]

Figure 12 : GitHub Logo

4. **Postman:** is an API platform for building and using APIs. Postman simplifies each step of the API lifecycle and streamlines collaboration so you can create better APIs—faster.

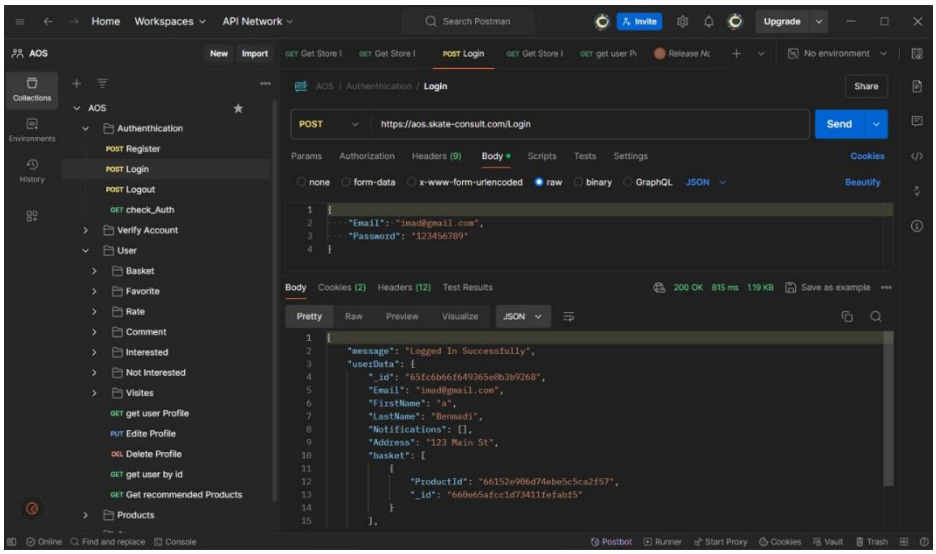


Figure 13: Interface of Postman Platform of our project

2.3.2 Programming Languages

1. **HTML:** HTML stands for HyperText Markup Language and it is used to create webpages. It uses **HTML tags**[4] and **attributes**[5] to describe the structure and formatting of a web page.

   HTML consists of various elements that are responsible for telling search engines how to display page content. For example, headings, lists, images, links, and more.[10]

2. **CSS:** CSS, or Cascading Style Sheets, is the secret sauce that styles all the websites you visit. It's a simple language that controls how HTML elements (like text, images, and buttons) are displayed on a webpage. With CSS, you can change

[4] https://www.geeksforgeeks.org/html-tags-a-to-z-list/
[5] https://www.geeksforgeeks.org/html-attributes/

the font size and color, add backgrounds, and control the layout, transforming a basic webpage into a visually appealing and user-friendly experience.[11]

3. **JavaScript: JavaScript** is the most powerful and versatile programming language used in the web. It is a **lightweight**, **cross-platform**, **single-threaded** and **interpreted** programming language. It is a commonly used programming language to create dynamic and interactive elements in web applications. It is easy to learn, compiled language.[12]

Why we used JavaScript language?

As a cornerstone of our development process, we have chosen JavaScript as the primary language for our e-commerce website. JavaScript, renowned for its versatility and widespread adoption, serves as the bedrock of modern web development. With our team's expertise honed over years of dedicated practice, we have become adept at harnessing the full potential of JavaScript. Through three years of intensive work, we have not only mastered its syntax and intricacies but also cultivated a deep understanding of its ecosystem and best practices.

JavaScript's pivotal role extends beyond mere proficiency; it forms the backbone of the MERN (MongoDB, Express.js, React, Node.js) stack, a robust and flexible technology stack widely embraced in modern web development. By leveraging JavaScript across the entire stack, from frontend to backend, we ensure seamless integration and synergy between different layers of our e-commerce platform. This cohesive approach facilitates efficient data flow, real-time updates, and dynamic user experiences, ultimately enhancing the performance and scalability of our application.

2.3.3 Database

MongoDB: is an open source, no relational database management system (DBMS) that uses flexible documents instead of tables and rows to process and store various forms of data.[13]

As a NoSQL-database[6] solution, MongoDB does not require a relational database management system (RDBMS), so it provides an elastic data storage model that enables users to store and query multivariate data types with ease. This not only simplifies database management for developers but also creates a highly scalable environment for cross-platform applications and services.[13]

MongoDB documents or collections of documents are the basic units of data. Formatted as Binary JSON (Java Script Object Notation), these documents can store various types of data and be distributed across multiple systems. Since MongoDB employs a dynamic schema design, users have unparalleled flexibility when creating data records, querying document collections through MongoDB aggregation and analyzing large amounts of information.[13]

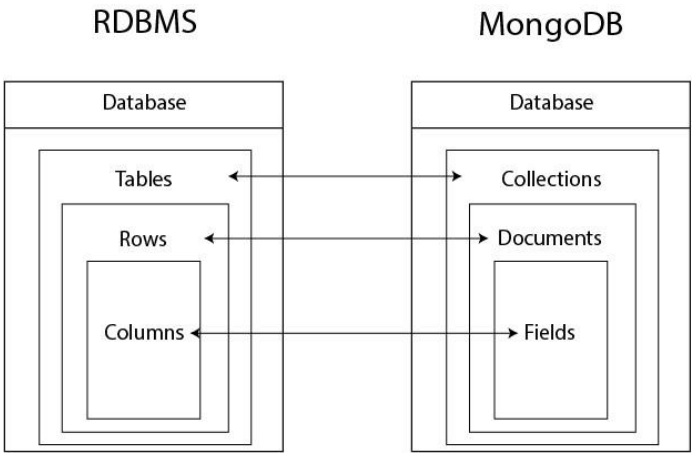


Figure 14: Explanation of MongoDB

2.3.4 Libraries and Framework Used

1. **React Js**: also known as React, is a popular JavaScript library for building user interfaces (UIs) on the web. React is a declarative, component based library that allows developers to build reusable UI components and it follows the Virtual DOM (Document Object Model) approach, which optimizes rendering

[6] https://www.ibm.com/topics/nosql-databases

performance by minimizing DOM updates. React is fast and works well with other tools and libraries.[14].

2. **Node. Js:** s an open source server environment that uses JavaScript on server. A Node.js application runs within a single process, without generating a new thread for each request. Node.js includes asynchronous I/O primitives as a part of its standard library, which prevents JavaScript code from blocking and, in general, libraries in Node.js are developed using non-blocking paradigms. This makes blocking behavior the exception instead of the rule.
3. **Express.js** is a fast, flexible and minimalist web framework for Node.js. Effectively a tool simplifies building web applications and APIs using JavaScript on the server side. Express is an open-source that is developed and maintained by the Node.js foundation.
4. **Tailwind CSS:** is a utility-first CSS framework that streamlines web development by providing a set of pre-designed utility classes. These classes enable rapid styling without writing custom CSS, promoting consistency and scalability. Tailwind's approach shifts focus from traditional CSS components to functional classes, empowering developers to efficiently build responsive and visually appealing interfaces with minimal effort.
5. **Mongoose** : is an ODM (Object Data Modeling) library for MongoDB. While you don not need to use an Object Data Modeling (ODM) or Object Relational Mapping (ORM) tool to have a great experience with MongoDB, some developers prefer them. Many Node.js developers choose to work with Mongoose to help with data modeling, schema enforcement, model validation, and general data manipulation. In addition, Mongoose makes these tasks effortless.

2.3.5 Reinforcement Learning Algorithms

Reinforcement Learning Algorithms: The platform will employ reinforcement-learning algorithms to analyze user preferences and behavior, providing personalized product recommendations tailored to individual user interests.

This diagram explains how the algorithm works

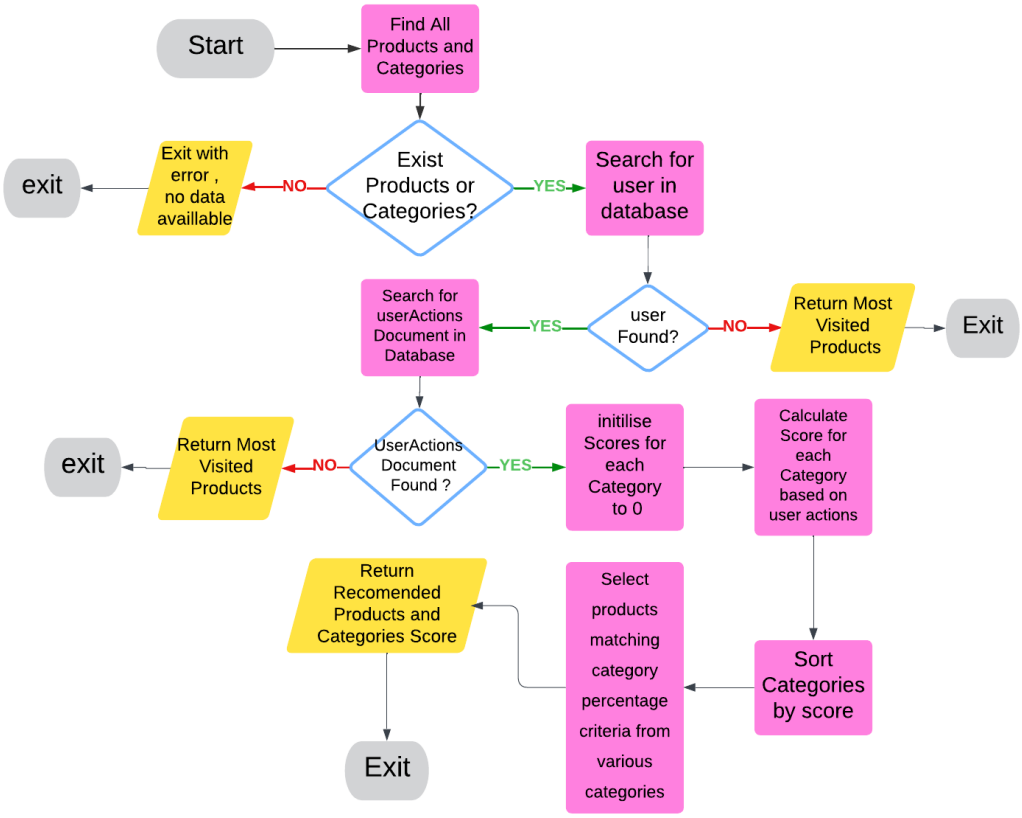


Figure 15: Recommandation System Flow chart

2.4 Summary

An image summarizing the development of the website, front and back

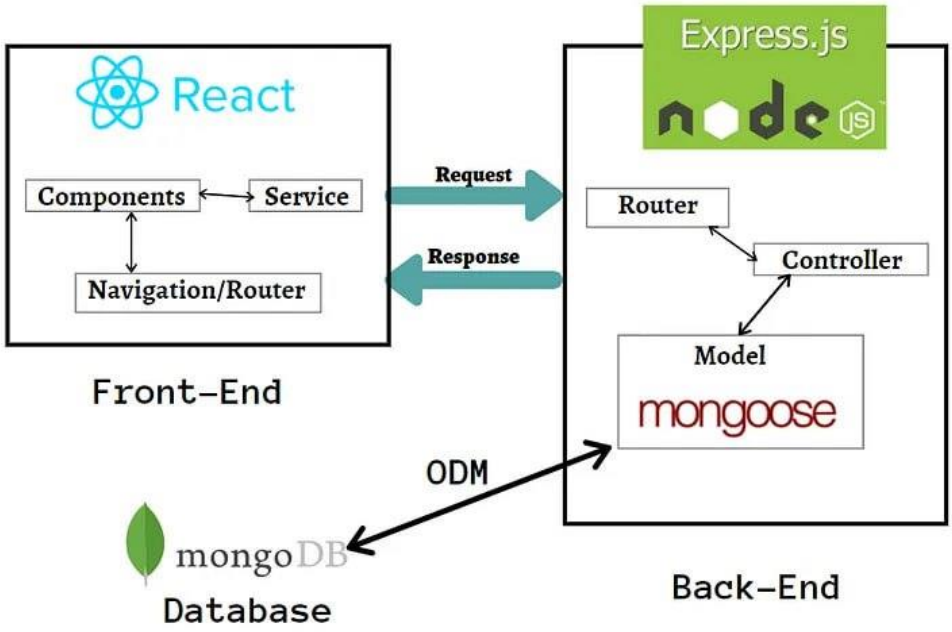


Figure 16: Summary of website development, front-end and back-end

Chapter 3 Validation

3.1 Introduction

The application of e-commerce is considered one of the most important factors contributing to the growth of the e-commerce sector. To ensure the success of the application and provide a satisfying user experience, several aspects must be taken into account:

3.2 Assessing the Functionalities

Evaluating the functionality of an e-commerce platform is crucial to ensuring its effectiveness and success. This process includes a thorough examination of the various features and capabilities offered by the platform.

1. **User Account Management:**

- Registration and Login: The platform provides the process of creating an account and logging in in a simple and secure way.

Figure 17: Registration and Login

- Profile Management: Users can update their personal information, view order history, and manage preferences easily.

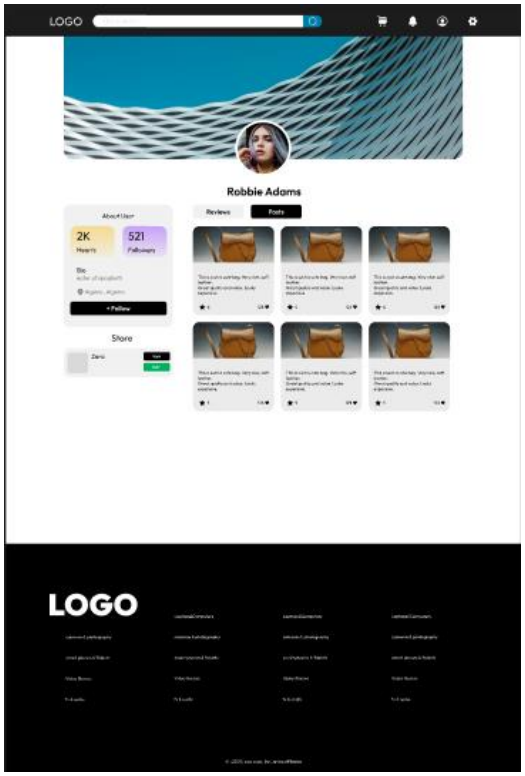


Figure 18: User Profile

2. Shopping cart and checkout process:

- Shopping cart management: The platform provides users to add, remove and modify items in their shopping cart effortlessly.

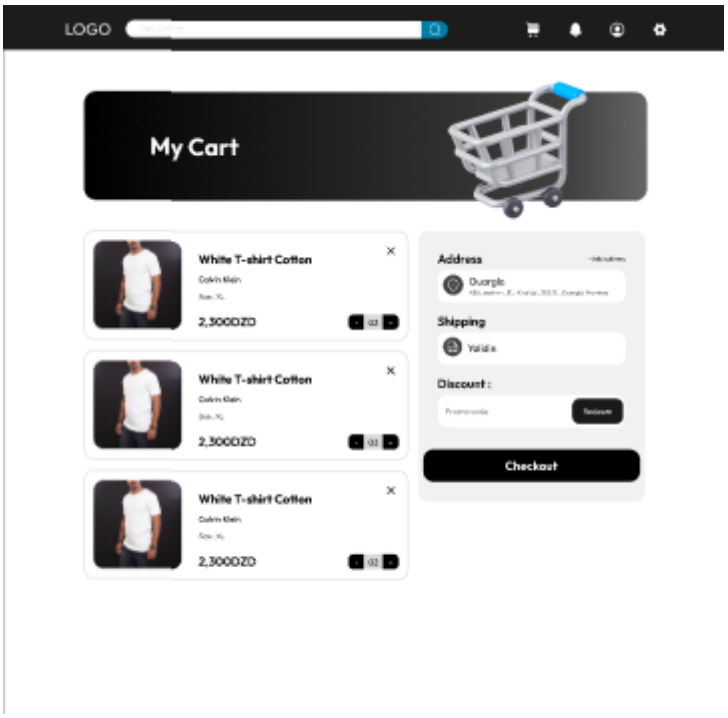


Figure 19: Shopping cart

3. Product Catalog Management:

- Ease of navigation: The platform allows users to browse categories and find products easily.

- Search function: The platform provides users with a search feature, offering filters and sorting options to help users quickly locate specific items.

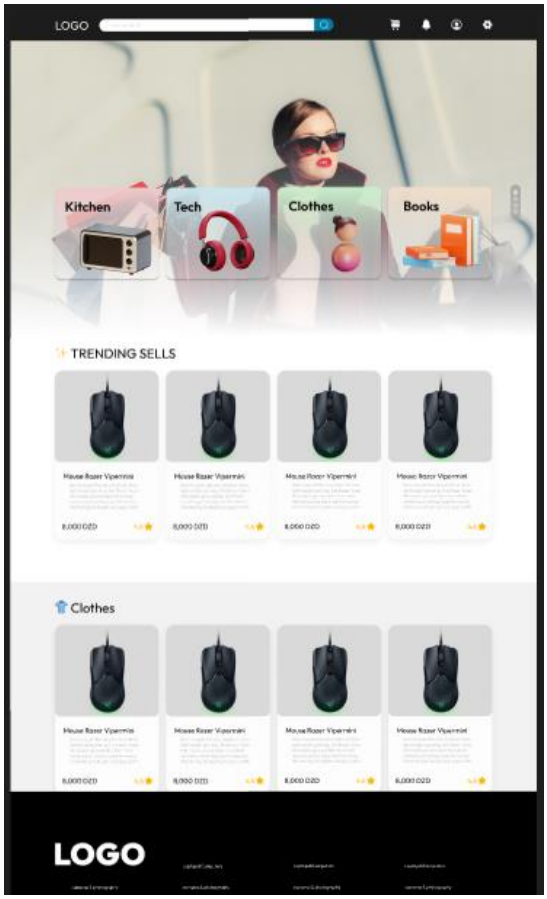


Figure 20: Search Function and Ease of navigation

- Product Information: The platform provides users with detailed descriptions, pictures and specifications for each product.

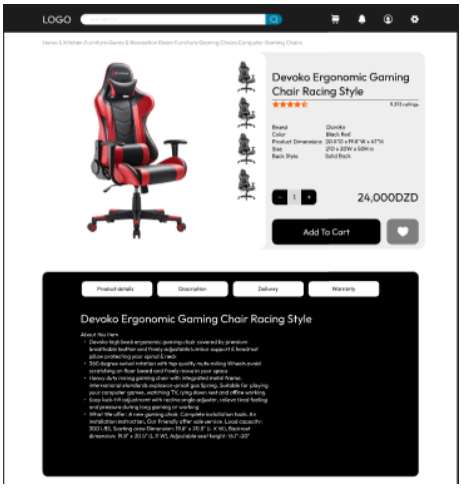


Figure 21: Product Information

4. **Seller Stores:** Each seller will have the opportunity to create and customize their own store within the AOS platform, allowing for personalized branding and product presentation They can also see requests, accepts and rejects, Message the buyer, View the balance and withdrawals, View sales and graphical curves.,

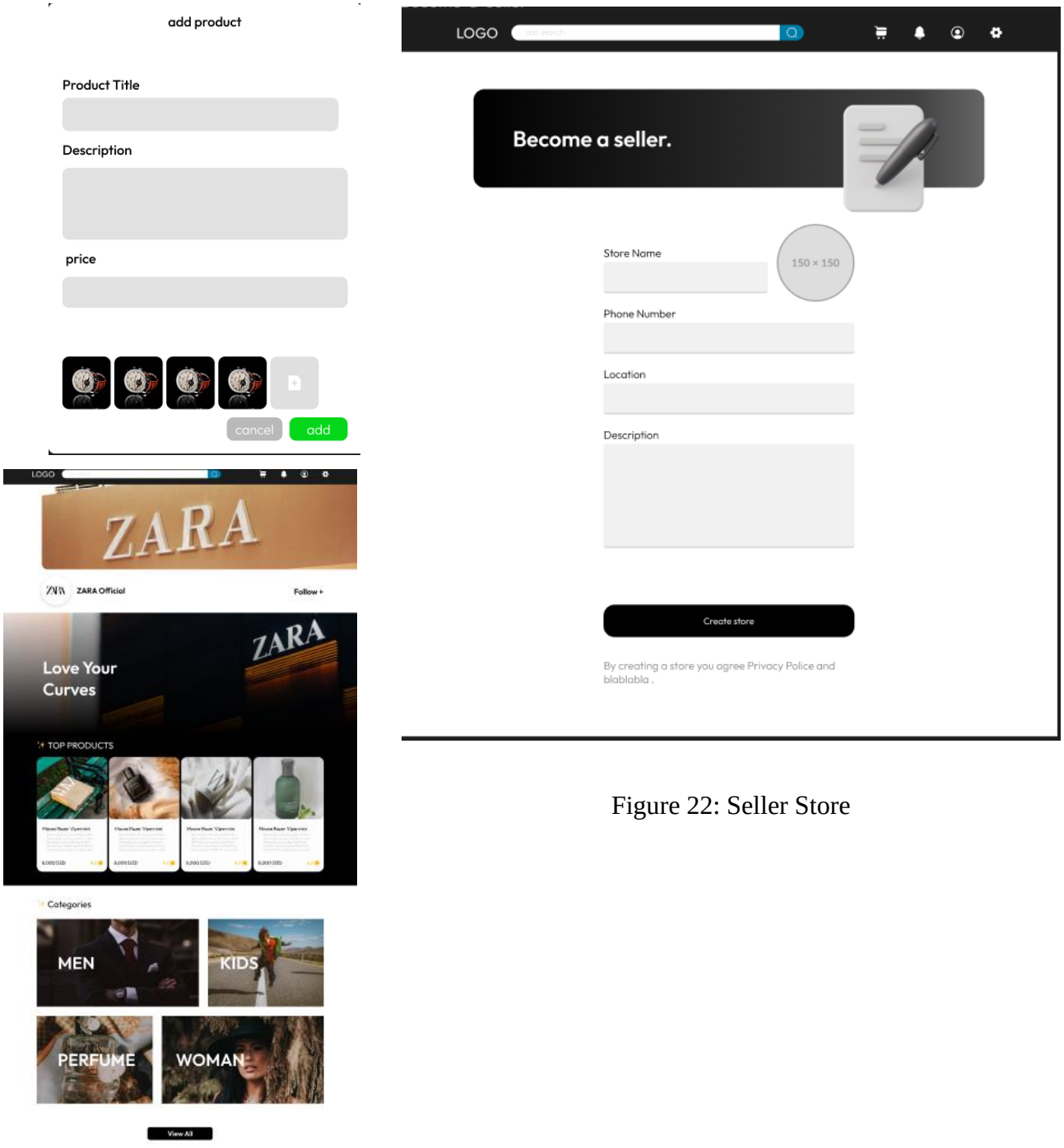


Figure 22: Seller Store

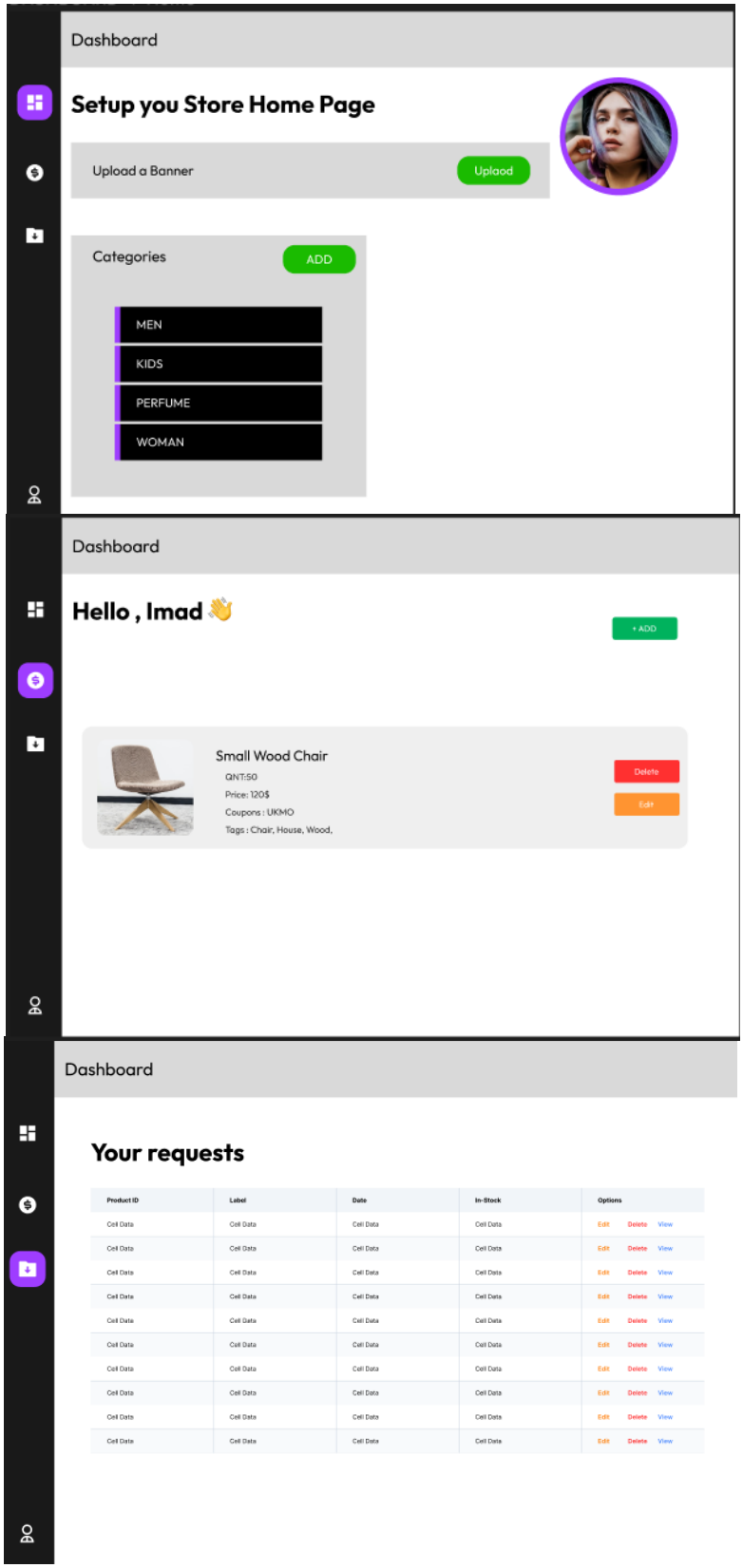
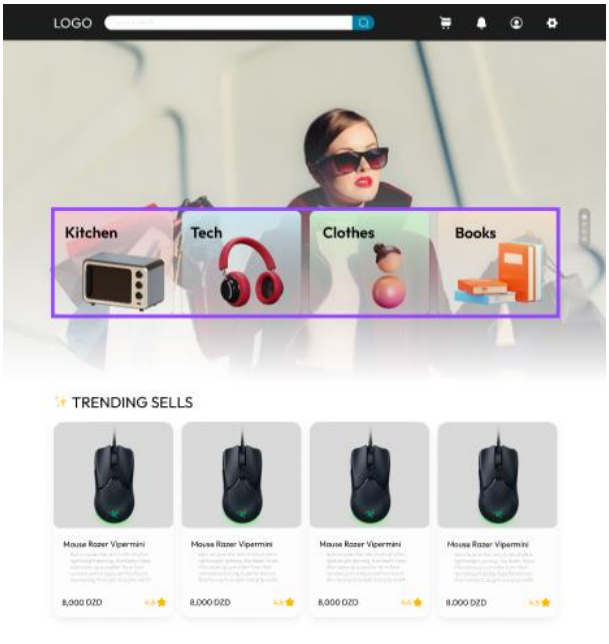
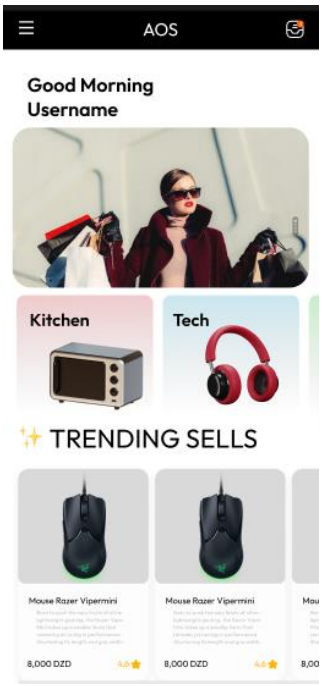


Figure 23: Dashboard

3.3 Usability and Compatibility

This project was created in response to usability requirements so that it is a user-friendly, intuitive and easy-to-use platform. It includes a clear user interface, simplified navigation, and easy-to-access features. Good usability reduces user abandonment rates and enhances satisfaction.





3.4 Reliability and Security

In this project, to meet reliability and security requirements, we have implemented several measures. First, we aimed to reduce code duplication, which simplifies the development process. Since this application contains sensitive data, we used Sonar Cloud to detect and fix vulnerabilities, as well as look for security hotspots. After a comprehensive evaluation on SonarCloud, we are happy to announce that our project has successfully met the minimum code quality and maintainability requirements, this allows us to enhance application security and protect confidential data, which enhances the readability and maintainability of our code base. Ultimately, these measures enable us to increase user engagement and satisfaction.

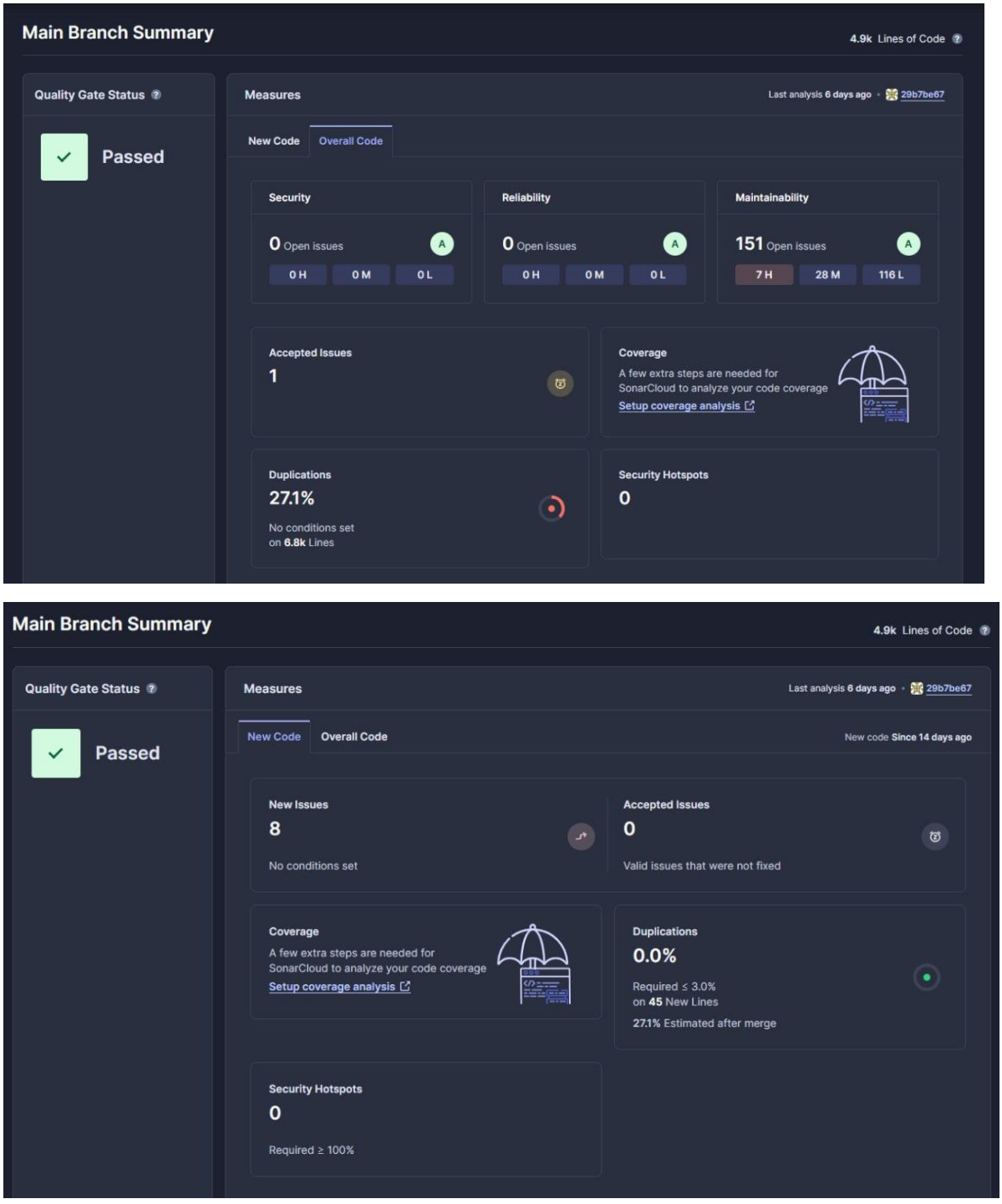


Figure 24: Logical Quality Report (SonarCloud)

Conclusion

The Algerian Online Store (AOS) project represents a significant step towards modernizing the e-commerce landscape in Algeria by providing a comprehensive platform that bridges the gap between local sellers and buyers. By leveraging cutting-edge technology and user-centric design principles, AOS aims to create an inclusive, efficient, and reliable online marketplace.

The project's contributions extend beyond the immediate benefits to buyers and sellers, impacting the broader economic and social fabric. Key contributions include:

1. Enhanced Accessibility: AOS offers a streamlined platform where buyers can easily access a wide range of products from local sellers. This convenience reduces the time and effort needed to find and purchase items, making online shopping more accessible to a diverse user base.

2. Increased Market Reach : For sellers, AOS provides an invaluable opportunity to reach a larger audience. By showcasing their products on a widely accessible platform, sellers can expand their market presence and drive sales growth.

3. Building Trust and Transparency: The inclusion of a rating and feedback system enhances trust and transparency within the platform. Buyers can make informed decisions based on reviews, while sellers receive valuable feedback to improve their offerings, leading to higher satisfaction levels on both sides.

Despite these promising contributions, the project faces several challenges and limitations:

1. User Base Expansion: The success of AOS hinges on its ability to attract and retain a substantial user base. Effective marketing and user acquisition strategies are crucial to achieving this goal.

2. Technical Demands: Developing a robust, secure, and scalable e-commerce platform requires significant technical resources and expertise. Continuous improvements and maintenance are necessary to keep the platform competitive and reliable.

3. Coordination and Management: Managing a diverse array of sellers and ensuring the quality and availability of products pose logistical challenges. Efficient coordination and support systems are essential to maintain high service standards.

4. Adaptability and Growth: As the e-commerce sector evolves, AOS must remain adaptable to new trends and technologies. Ensuring the platform can scale and adapt to changing user needs is vital for its long-term success.

From a business model perspective, AOS needs to implement sustainable revenue-generating strategies, such as transaction fees, subscription models, and premium services. This financial sustainability will enable continuous innovation and improvement of the platform.

In conclusion, the AOS project has the potential to significantly transform the e-commerce landscape in Algeria. By effectively addressing the technical, operational, and strategic challenges, AOS can become a leading platform that not only connects buyers with local sellers but also fosters economic growth and enhances the overall online shopping experience.

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