



USJE-COM

E-COMMERCE WEB APP

FINAL REPORT

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1. INTRODUCTION

1.1 PROJECT BACKGROUND

E-commerce pertains to the sector of commerce that concentrates on executing online business transactions encompassing electronic methods. It includes exchanging goods or services through internet platforms and has become increasingly popular with the widespread adoption of the internet.

The e-commerce domain consists of a wide range of businesses, including B2C (business-to-consumer) and B2B (business-to-business) models, as well as various sectors such as retail, travel, electronics, hospitality, and services. It offers convenience, global reach, and new business opportunities for both traditional businesses and online-only enterprises, enhancing the overall business landscape.

Key Components of the E-commerce Domain: Online Shopping Platforms, Product Catalog, Shopping Cart, Payment Gateways, Order Management, Customer Accounts, Security, Logistics and Shipping, Customer Support, Marketing and Promotions, Analytics and Insights, Mobile Commerce

1.2 PURPOSE OF THE REPORT

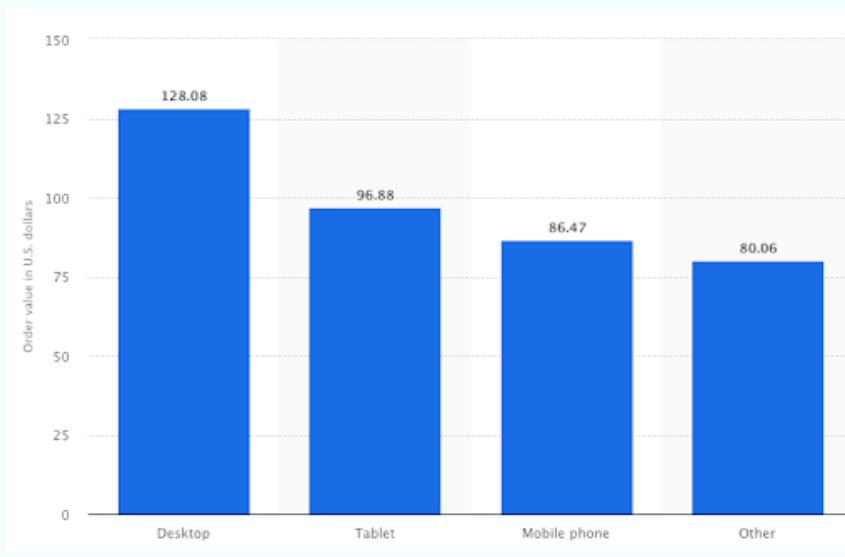
The purpose of this report is to provide a detailed account of the development process, features, and technical aspects of our E-commerce web application, **USJE-COM** which is focused on electronic and tech products. This report aims to document each phase of the project, from the initial design and planning stages to the final deployment and maintenance strategies. This report serves as a comprehensive guide to understanding how the application was built and implemented by outlining the key components and functionalities of the application.

Additionally, this report intends to bring forth the difficulties experienced during the developmental phase, how we managed to overcome them through a collaborative approach and the lessons learned throughout the process. Moreover, It aims to serve as a reference for future enhancements and provide insights into potential improvements that can be made to the application as well.

2. MOTIVATION

2.1 MARKET NEEDS FOR ELECTRONIC AND TECH PRODUCTS

The consumer electronics industry which is evolving rapidly and continuing to boost up with innovation everyday, sees major manufacturers churning out advanced electronic items, continuously enhancing user-friendliness and sophistication while creating features targeted at customer assistance and entertainment. The electronics industry has been a major part of the ecommerce sector with 43% of these purchases being made online, with £23 billion spent on consumer electronics in 2020.



Online shopping has become the preferred choice for majority of consumers in 2020 as a result of stores being closed due to the pandemic. Moreover, people are exhibiting an increased hesitancy towards in-person shopping due to uncertainties surrounding particular stores' safety and a disinterest in getting contacted with other individuals. This presents an opportunity to leverage electronic sales through online platforms.

Top competitors in Consumer Electronics, 2024

- Amazon
- Walmart
- Fnac
- eBay
- Target

2.2 TEAM MOTIVATION

Our motivation for developing the USJE-COM E-commerce web application derives from a deep interest in the electronics and tech industry and personal interest in exploring the principles and layout behind online shopping. After doing some research, we came to recognize the growing demand for a specialized platform that caters specifically the needs of tech enthusiasts, as a majority reputed, large scale e-commerce companies seemed to cover a wide range other products as well.

As a team, we were driven by the opportunity to learn and implement cutting-edge technologies, such as the MERN stack, to build a solid and scalable platform employing the limited resources we had. Our major intention was to create a user-friendly application that may enhance the overall shopping experience.

3. PROBLEM AND OBJECTIVES

3.1 PROBLEM STATEMENT

The e-commerce market is experiencing a significant gap in the market for a platform exclusively catering to tech and electronic products. Though large companies like Amazon and eBay dominate the market, their broad focus tends to disrupt the experience for tech enthusiasts who seek a specialized platform. Navigating through non-tech items, unclear technical specifications, and limited tools for comparing products based on specific features are frequent challenges faced by tech enthusiasts. These difficulties may lead to frustration and inefficiency, especially for those with a deep interest in technology.

Our web application aims to enhance the shopping experience for tech enthusiasts by offering a hand-picked selection of electronic and tech products, providing clear technical specifications, and facilitating to upload products of preference. This specialized approach ensures users can easily find, and purchase tech products without the distractions and inefficiencies found on broader e-commerce platforms.

3.2 OBJECTIVES OF THE PROJECT

The primary objective of this project is to deliver a seamless and efficient e-commerce platform tailored specifically for tech and electronic products. In order to achieve this, we focused on meeting several key goals.

First key goal was creating a responsive and User-Friendly interface that enhances the shopping experience for customers. There, we took into account key aspects such as, easy navigation, clean and minimalistic design that allows users to browse items across various devices.

Integrating a solid search and filter system also one of the main objectives which may allow users to efficiently find products based on brand, keywords, specifications, price range and product category.

Offer detailed product specifications, including technical specifications, features, price, and customer reviews to aid in making informed decisions when purchasing or searching products.

Designing the platform to be scalable and to enhance performance, ensuring that it can handle a growing number of users and products without compromising speed or functionality. Here, we aim to optimize the backend architecture and database to support potential future expansion.

Implement necessary security measures to protect user data, including secure authentication methods and data protection regulations to ensure long-term success of the platform.

3.3 SCOPE OF THE PROJECT

Included Features and Functionalities

- Product Browsing - User will be able to browse a wide range of electronic and tech products. The platform will provide organized categories and subcategories to streamline the browsing experience, allowing users to quickly find the products they are interested in.
- Search and Filter - User will be facilitated with a search and filter system that may enable to search products by product name, brand or other key words and the filtering option may enable to filter search results by product category and price range.
- Detailed product specifications - Each product will include a comprehensive description about the product which may help user in making informed purchasing decisions.
- Add to and delete from Cart - User will be able to add products to the cart and delete any product from cart. User will also be able to manage the quantity of the product after adding it to the cart.
- User account management - User account functionalities will allow user to login, register, authenticate, manage and personalize user profile and update personal information.
- Product upload and management (Admin panel) - An admin panel will be implemented to enable administrators to manage the product catalog. Admins will have the ability to upload new products, edit and manage existing products and manage user accounts.
- Responsive design - The application is designed to be responsive across various devices, including desktops, and smartphones.

Limitations and excluded Features

- Third-Party integrations - Third-party services, such as external payment gateways and inventory management systems will not be included in the initial version of the application.
- Advanced analytics and reporting - Advanced analytics and reporting features such as predictive analytics, customer behavior analysis will not be included in the current version.
- AI-based recommendations - AI-based recommendations will not be integrated in the initial version. However, this feature may be considered in future enhancements.
- Multi-currency support - The application will be equipped with a single currency in mind (LKR), focusing on the particular local market.
- Comprehensive marketing tools - Comprehensive marketing tools such as email campaigns and customer segmentation will not be included in the initial version.

4. SYSTEM OVERVIEW

4.1 OVERVIEW OF THE APPLICATION

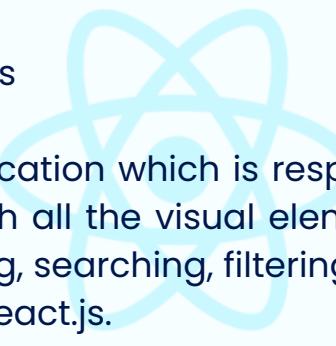
USJE-COM E-commerce web application is built using the **MERN stack** (MongoDB, Express.js, React.js, Node.js), ensuring a modern, scalable, efficient and user-friendly platform that is intended to provide a shopping experience specifically tailored to electronic and tech products.

The architecture of the whole system is divided into three primary components; **Frontend**, **Backend**, and **Database**.



Frontend

- Technology used -React.js
- The frontend of the application which is responsible for user interface and interaction, equipped with all the visual elements and interactive features such as, product browsing, searching, filtering, uploading and adding items to the cart is built using React.js.



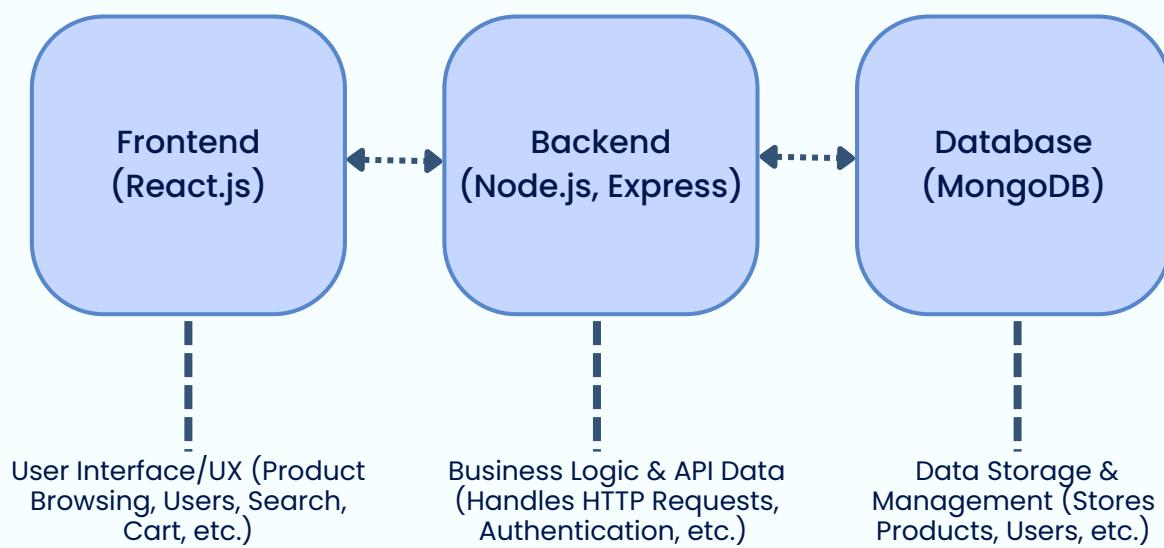
Backend

- Technology used: Node.js, Express.js
- The server-side logic and API layer of the application is managed by the backend, which handles all business logic, data processing and communication between frontend and database. Node.js runs Express.js to manage HTTP requests, user authentication, product management and other core functionalities. The backend facilitates secure performance at the same time ensuring that necessary data reaches frontend clients effectively.

Database

- Technology used: MongoDB
- All the data related to users, products, and other entities is stored in the database. In this case, MongoDB, which is a NoSQL database is used to facilitate storing and retrieving product and user data efficiently. MongoDB is employed in particular due to its flexibility in handling various types of data such as detailed product specifications and etc.

System Architecture



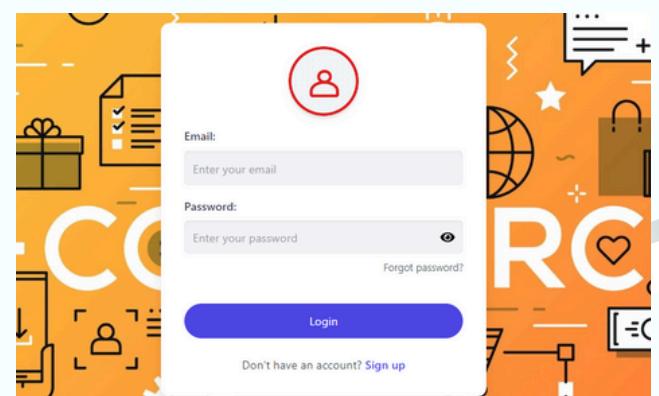
4.2 KEY FEATURES AND CAPABILITIES

User Authentication

- A new user can register or sign up using name, email and password. An already registered user can log in using the email and password.
- Moreover, features like encrypted passwords, token-based authentication, and a "forgot password" option are implemented to ensure a safe shopping experience for the user.



Sign Up page



Log In page

Home Page

- In Home page features a product category listing where user can explore different products such as cameras, mobiles, printers and, etc.
- Promotion banners of ongoing deals, new arrivals, and special offers are showcased in the home page
- User can also scroll down the home page to view highlighted top products and popular product listings.

Category list and Promotion banners

Product listings

Top's Airpodes

Popular's Watches

Mobiles

Mobiles

Mouse

Product detail page

- Selecting a product, user can navigate to the product detail screen where there are relevant product specifications along with multiple images from different angles.
- User can also see discounted prices with the initial prices and customer reviews as well.
- Recommended products related to the selected product are also displayed in the product detail screen.

The screenshot shows a product detail page for an Acer I Series 127 cm (50 inch) Ultra HD (4K) LED Smart Android TV. The main image displays the TV with its screen showing a green and yellow abstract pattern. Below the TV, text highlights "50" 2 YEARS", "acer", "androidtv 11", "4K UHD", "30W Dolby Audio", and "MEMC (2022 Model)". The product title is "acer I Series 127 cm (50 inch) Ultra HD (4K) LED Smart Android TV with Android 11, 30W Dolby Audio, MEMC (2022 Model) (AR50AR2851UDFL) 1". It has a price of LKR 55,000.00 and a discounted price of LKR 60,000.00. Buttons for "Buy" and "Add To Cart" are visible. A "Description" section is present below the main image. A "Recommended Product" section at the bottom shows a smaller image of another Acer TV.

Product details, images, prices and customer reviews

The screenshot shows a product detail page for boAt earbuds. The main image displays the earbuds in their dark blue charging case. Below the image, the text "Fast and efficient with unique connectivity options" is visible. A "Recommended Product" section at the bottom shows four smaller images of different earbud models.

Image zoom option

The screenshot shows a product detail page for boAt earbuds. The main image is partially visible at the top. Below it, a "Recommended Product" section displays four items: "boAt Airdopes 111" (LKR 39.99), "airdrop2.0" (LKR 11.00), "boAt Airdopes 111 1" (LKR 850.00), and "boAt Airdopes 111 2" (LKR 750.00). Each item has an "Add to Cart" button. A "Recommend related products" section is visible on the right side of the page.

Recommend related products

Search and Filter Options

- User can search a product by name, brand or any other keyword.
- User can refine the search results by applying filtering options such as filter by price range and category.

Search Results : 5

Image	Name	Category	Price	Action
	Canon MG2570S Multi-functio...	Printers	LKR 22,000.00	Add to Cart
	Canon EOS 5D Mark IV 30.4 M...	Camera	LKR 82,000.00	Add to Cart
	Canon EOS 5D Mark IV 30.4 M...	Camera	LKR 52,000.00	Add to Cart
	Canon EOS 1500D 24.1 Digital...	Camera	LKR 44,000.00	Add to Cart
	Canon EOS 1500D 24.1 Digital...	Camera	LKR 22,000.00	Add to Cart

Search by product brand

Search Results : 5

Image	Name	Category	Price	Action
	realme 7 Pro (Mirror Silver, 128...	Mobiles	LKR 37,990.00	Add to Cart
	realme 7 Pro (Mirror Silver, 128...	Mobiles	LKR 22,997.00	Add to Cart
	realme 9 5G (Stargaze White,...	Mobiles	LKR 31,997.00	Add to Cart
	realme 9 5G (Stargaze White,...	Mobiles	LKR 65,000.00	Add to Cart
	realme 9i 5G (Soulful Blue, 64...	Mobiles	LKR 99,000.00	Add to Cart

Filter by category

Search Results : 5

Image	Name	Category	Price	Action
	CP PLUS 3MP Full HD Smart W...	Camera	LKR 10,990.00	Add to Cart
	Canon EOS 1500D 24.1 Digital...	Camera	LKR 44,000.00	Add to Cart
	Canon EOS 5D Mark IV 30.4 M...	Camera	LKR 52,000.00	Add to Cart
	Canon EOS 1500D 24.1 Digital...	Camera	LKR 66,500.00	Add to Cart
	Canon EOS 5D Mark IV 30.4 M...	Camera	LKR 11,990.00	Add to Cart

Filter by price range
(High/low)

Shopping Cart

- User can add to or remove products from the cart though checkout functionality id not yet implemented.
- User can also manage the quantity of the product and view the total cost.

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shop here

search product here...

All X Logout

Summary		
Quantity	3	LKR 49,998.00
Total Price		

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Product	Category	Price
Canon EOS 1500D 24.1 Digital SLR Camera (Black) with EF S18...	Camera	LKR 44,000.00
boAt Rockerz 450 Batman DC Edition 1	Earphones	LKR 3,999.00
HP 250 Wireless Optical Mouse (2.4GHz Wireless, Black) 2	Mouse	LKR 1,999.00

Shopping cart

USJE-COM
shop here

search product here...

All X Logout

Summary		
Quantity	7	LKR 225,998.00
Total Price		

Manage quantity

Product	Category	Price
Canon EOS 1500D 24.1 Digital SLR Camera (Black) with EF S18...	Camera	LKR 220,000.00
boAt Rockerz 450 Batman DC Edition 1	Earphones	LKR 3,999.00
HP 250 Wireless Optical Mouse (2.4GHz Wireless, Black) 2	Mouse	LKR 1,999.00

User Account Management

- User can edit profile by updating personal information such as name, shipping address, contact number and profession and save the changes.

USJE-COM
shop here

search product here...

All X Logout

Name: Lakmini

Telephone: 1234567890

Address: 50, Lakeside, Ampitiya, Kandy

Profession: Student

Admin Panel

- The admin panel facilitates managing the product catalog, including adding, editing, and deleting products.
- Administrator also can manage user accounts.

All products uploaded

All the Users

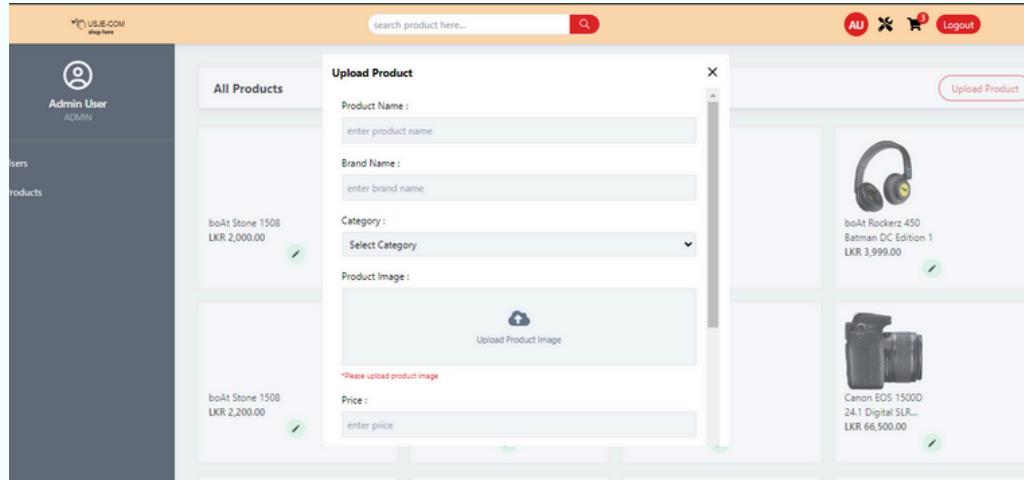
Sr.	Name	Email	Role	Created Date	Action
1	Kisara Randeniya	kisaran@gmail.com	ADMIN	August 17, 2024	✓
2	sumai	sumai@email.com	ADMIN	August 19, 2024	✓
3	sumai	sumai123@gmail.com	GENERAL	August 19, 2024	✓
4	testUser	test@gamil.com	GENERAL	August 23, 2024	✓
5	sumai Nadera	sumai1@email.com	GENERAL	August 26, 2024	✓
6	sumai Naderae	sumaisg@gmail.com	GENERAL	August 26, 2024	✓
7	Pramudi Perera	pramuanan@gmail.com	GENERAL	August 27, 2024	✓
8	Kisara Seller	kisaraseller@gmail.com	GENERAL	August 27, 2024	✓
9	Lakmini Rathnayake	lakmini@gmail.com	GENERAL	August 28, 2024	✓
10	Admin User	adminuser@gmail.com	ADMIN	August 29, 2024	✓
11	sumai	sumai123@email.com	GENERAL	August 29, 2024	✓

AssignUser roles

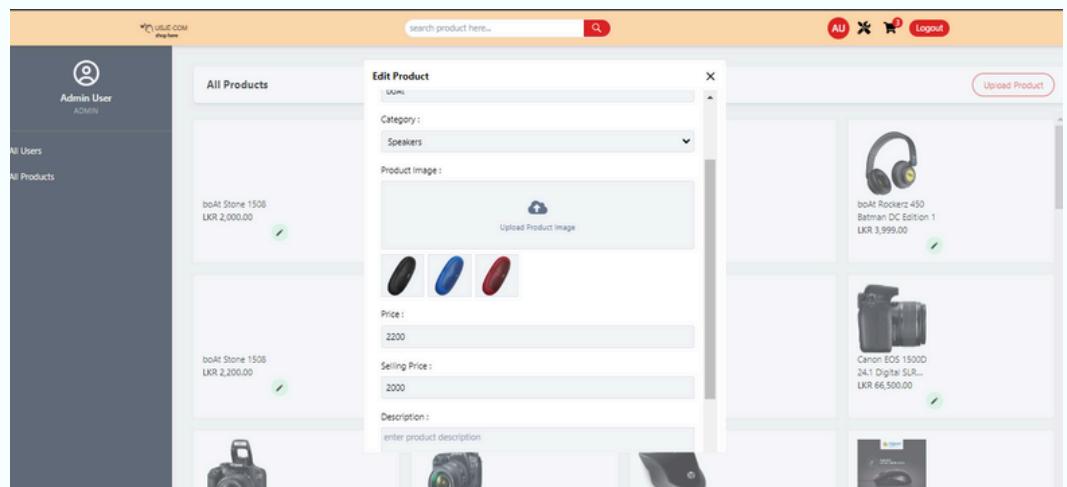
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Product Upload and Management

- Administrator can upload new products along with relevant product specifications, brand, category, images and pricing.



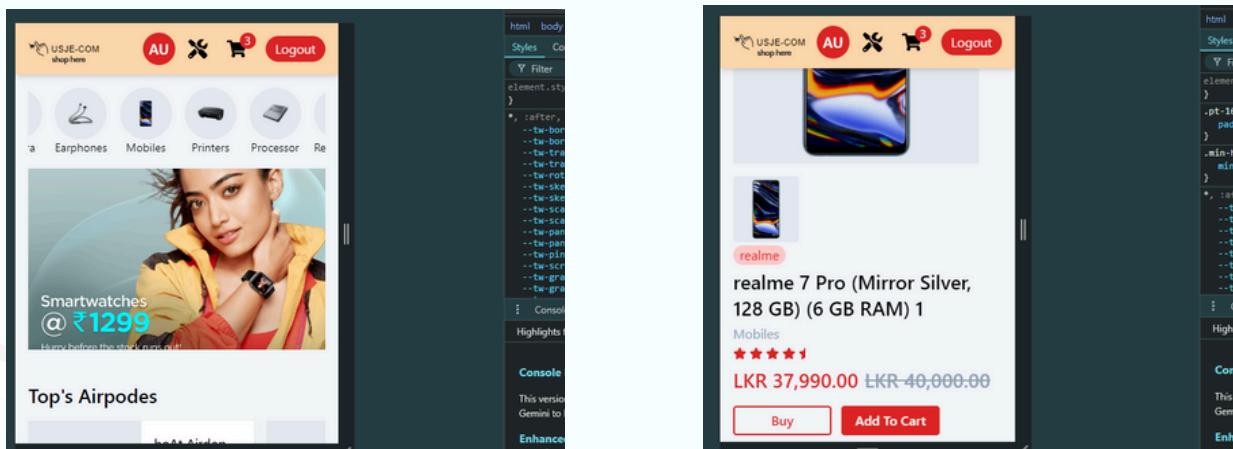
Product Upload window



Edit Product Details

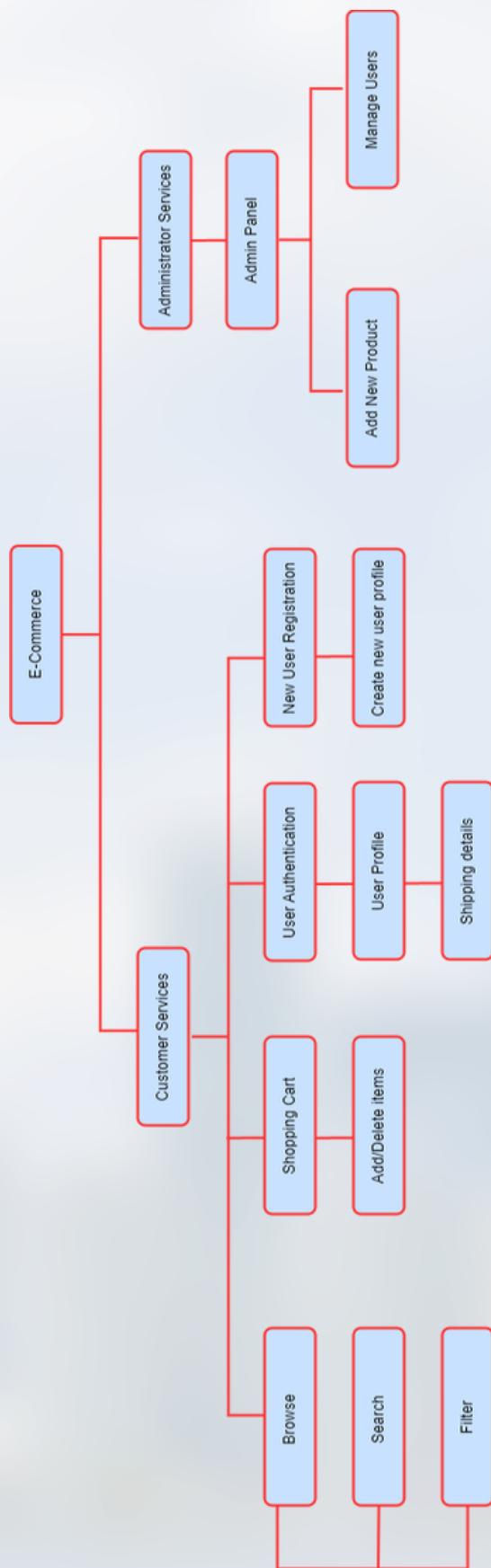
Responsive Design

Mobile View



4.3 FUNCTIONAL DECOMPOSITION DIAGRAM

A decomposition diagram shows a top-down functional decomposition of a system and exposes the system's structure. The objective of the Functional Decomposition is to break down a system step by step, beginning with the main function of a system and continuing with the interim levels down to the level of elementary functions.



5. DATABASE STRUCTURE

5.1 DATABASE DESIGN OVERVIEW

The database design for the USJE-COM e-commerce web application created to facilitate the storage, retrieval and administration of data related to products, user accounts, and other entities. We, as a team decided to employ MongoDB as our Database Management System (DBMS) as it's a NoSQL database and it offers various benefits such as flexibility, scalability, ease of use and the ability to handle dynamic data structures.

5.2 DESIGN APPROACH

MongoDB has a document-oriented structure where data is stored in JSON-like documents which for easy modeling of complex data like product specifications, user information, and cart items.

The database is organized into collections such as 'users', 'products', and 'cart-products', each representing a different entity within the application.

Each collection mentioned above contains documents that store the actual data. Ex: 'Products' collection has documents representing individual products, along with all the other details like name, description, technical specifications, and associated images.

6. DETAILED EXPLANATION OF API IMPLEMENTATIONS

6.1 USER MANAGEMENT API

The User Management API handles all user-related operations. Its main operation includes managing user accounts, including registration, authentication, and profile management. These operations ensure that the users have a secure access to the features across the application. Since there are different user roles, the API also provides appropriate access levels for general users and admins.

Key endpoints

User Registration - Allows a new user to create an account by providing details such as name, email, and password. Once a new user enters data, they get validated by this endpoint, creating a new user record in the database, and returns a confirmation message.

User Login - Verify email and password authenticating the user. If the authentication is successful, a JSON Web Token (JWT) will be generated and returned to the user.

User Profile Management - Allows users to view and update their personal information. Current profile details of the user are retrieved using a 'GET' request and then allows the user to update fields such as name, email, and password through a 'PUT' request.

User Roles and Permissions - Retrieves the role of the logged-in user (admin/general user). This endpoint responsible in making sure that the appropriate permission corresponding to the relevant user role is granted to access certain features.

Admin-Specific Endpoints - These endpoints are only accessible by users with admin privileges such as view all users, update user roles, and delete user accounts

6.2 PRODUCT MANAGEMENT API

The Product Management API handles complex data associated with products in the application. It supports all essential operations including adding new products, updating existing product details, deleting products, and retrieving product listings.

Key endpoints

Add New Product – Through a ‘POST’ request, admin users are allowed to upload a new product along with other product details and multiple product images for a comprehensive view of the product. After validating the necessary input fields, product data is stored in the database.

Edit Product – The ‘PUT’ request allows admins modify product details, such as updating specifications, changing pricing, or adding new images. The API checks the product ID and only the included fields in the request body are updated without compromising the fields.

Delete Product – By specifying the product ID, a ‘DELETE’ request allows admins to permanently delete a product from the database.

List all Products – This endpoint returns a list of products through a ‘GET’ request. It also supports filtering option based on category or price.

Get Product Details – A ‘GET’ request returns all details of a product including its specifications, images, prices and, customer reviews.

6.3 CATEGORY MANAGEMENT API

This API ensures that the users can easily find products based on their specific interests. It manages product categories, enabling Admins to define, update, and organize categories and list out top and popular products within these categories as well.

Key endpoints

Add New Category – A ‘POST’ request allows admins to define categories based on product types (Laptops, Smartphones).

Delete Category – Admins can delete a category via ‘DELETE’ request by specifying the category ID and it will remove the category from the database, ensuring it no longer appears in the product listings.

List all Categories – A ‘GET’ request returns a comprehensive list of categories available.

6.4 CART MANAGEMENT API

The Cart Management API facilitates users in managing their shopping carts by providing essential operations for adding, deleting, managing and viewing products in a user's shopping cart.

Key endpoints

Add Product to Cart – A 'POST' request allows the user to select a product and add it to his/her cart. If the product is already in the cart, the API pops up an alert message to inform the user.

Delete Product from Cart – By specifying the product ID, a 'DELETE' request allows the users to remove items from their cart.

Count Cart Products – This endpoint returns the total count of distinct products in the user's cart via 'GET' request. The count will be displayed through the cart icon on the frontend

Manage Product Quantity – A 'PUT' request allows users to increase/decrease the quantity of a product by specifying the product ID and the cart will be updated accordingly.

View Cart Products – A 'GET' request returns a detailed list of the products in the cart, including product names, images, prices, quantities, and total cost.

7. SERVER HOSTING

7.1 HOSTING PLATFORM AND DEPLOYMENT

Hosting Platform – **AWS Lightsail** was selected as the hosting platform to host the web application. Since our web application is implemented as a university project with limited financial resources, Lightsail was a simplified and cost-effective choice that was ideal for deploying a full-stack MERN application.

Moreover, AWS Lightsail provides a reliable and scalable environment with pre-configured development stacks, including support for Node.js and MongoDB, which are integral to the MERN stack.

Deployment – Once the Lightsail instance setup is completed, necessary ports for backend and frontend communication are configured. Then the Node.js server and React.js frontend are deployed and the database is managed using a MongoDB service.



8. SUMMARY

8.1 CHALLENGES FACED

Narrowing Down the Topic

Initially, it was a challenge to narrow down the broad scope of E-commerce that was suitable for a university project. Thus, upon group discussions and individual research we identified narrowing down the topic to electronic and tech products would give us a good potential in developing a platform for the tech enthusiasts.

Limited Resources

As a team of university students, we had to work within the constraints of limited financial and technical resources which made us look for convenient and correct technology choices and deployment strategies.

Meeting Deadline

In the middle of the exams, we had to carefully plan the limited time we were given effectively, prioritizing the necessary tasks and ensuring the project is on track.

Remote Collaboration

The team working remotely was an added challenge to the project as we had to coordinate tasks and maintain an effective communication throughout the process. Thus, we made sure to inform and update ourselves via regular online meeting platforms and chats.

8.2 FUTURE WORK AND ENHANCEMENTS

Checkout and Payment Integration

Since the initial version of the application does not have a feature for a customer to purchase a product, we hope to implement a checkout feature that integrates with third-party payment gateways to facilitate users to complete their purchases securely.

Order Management

Since the current version is not equipped with checkout feature, it also lacks order management options. Thus, the future releases will be implemented with features such as order tracking, order status updates, and purchase history, to enhance the user experience.

Product Range Expansion

Future enhancements will also include expanding the range of electronic and tech products that would cater to a broader audience.

Customer Support

The current version of the application does not facilitate the user to contact the seller for further inquiries. Therefore, a chat option will be implemented in the future to allow users to contact sellers directly which will also eventually help in improving customer service and engagement.

8.3 CONCLUSION

The process of developing **USJE-COM**, which is an E-commerce web application for electronic and tech products was a valuable learning experience for us as university undergraduates as we were met with numerous challenges and also found ways to overcome them achieving significant milestones. This project not only gave us the confidence that we are able to use modern technologies applying complex concepts on them to build a initial version of a complex web application, but also gave us a glimpse of the working nature of the outside industry where we are about to step in. We were learned to work collaboratively even though the team was working remotely. In conclusion, the current version of the platform lays a solid foundation. Thus, we hope there is ample opportunity for future enhancements that could make the application even more robust and user-friendly.

END....