Process MeNtOR 3.0

Uni-SEP

Content adapted from the deliverables prepared by Dr. Kostas Kontogiannis

EVoltMarket

Design Document

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v3	Oct 11, 2023	Everyone	Added all diagrams required and edited them as required for final submission
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Document Sign-Off

Name (Position)	Signature	Date
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Contents

1   Introduction

1.1   Purpose

An online ecommerce platform for electric vehicles addresses several challenges and provides solutions to various problems in the electronic vehicle industry. An online ecommerce platform for electric vehicles can improve accessibility by providing shipping to locations where dealerships are not as common such as in remote places. Many dealerships also provide limited options but with our ecommerce platform we can provide multiple different electric cars with a whole myriad of options. We aim to solve the problem of inappropriate review cases hurting both website compliances and business revenue and marketing strategy by requiring review of customer reviews by administrators. When the user first accesses the website, they are not granted any temporary cookies to boost performance of the website. This should create a better user experience which promotes the sale of more environmentally friendly transport options.

The objective of the project is to provide an online e-commerce platform catering specifically to electric vehicle sales interactions. Specifically the aim is to create a complete user experience. The user can pick their preferred model through the search function, can customize the car to their needs, can compare their model to other available models and can also make smart financial decisions by calculating loan payment plans. The platform administrators can also run detailed reports on vehicle sales and application usage.

1.2   Overview

The goal of this project is to provide a specialized e-commerce platform to facilitate the sales of electric vehicles. The introduction section explains the purpose, overview as well as references used for the project report. The major design diagram includes the rationale behind the design decisions, including the choice of design patterns and architectural patterns. It also includes the description of the modularization criteria. The use case diagram action features a use case diagram that shows the use cases supported by the system. The next section, Sequence Diagrams, shows our sequence diagrams that correspond to 3 of our use cases: registering a customer, browsing a catalog and checking out. The next section, Architecture, focuses on breaking down the system into a package diagram, a component diagram, and a description of three modules used and their interactions. This section also includes a table form of the use cases shown in the diagram. The sixth section, Activities Plan, focuses on breaking down how the project will be developed. It includes a Gantt chart, as well as a meeting backlog. The last section is the Test Driven Development section, which covers 16 test cases and their expected outputs.

1.3   Resources - References

Paper 1: *E-commerce Architecture and System Design*

https://link.springer.com/chapter/10.1007/978-3-540-49645-8_8

This paper examines the history of E-commerce system design, as well as examines how they can be implemented today. These topics include basic principles, design methods, data flow structure, and system architecture principles which should be followed when designing an E-commerce system.

Paper 2: *CONCEPT OF E-COMMERCE: SYSTEMS ANALYSIS AND DESIGN FOR ONLINE-STORES*

https://www.researchgate.net/publication/335159397_CONCEPT_OF_E-CO MMERCE_SYSTEMS_ANALYSIS_AND_DESIGN_FOR_ONLINE-STORES

This paper focuses on how security, profiling and control should be implemented in an e-commerce system. It also suggests that processes such as design of the project, payment systems, content management, and search management should be a coordinated effort. It also focuses on core concepts such as search management, catalog management, event notifications, and collaboration and testing.

Website 1: Why Use MongoDB: What It Is and What Are the Benefits

https://www.simplilearn.com/tutorials/mongodb-tutorial/what-is-mongodb

This website focuses on what MongoDB is, what it is and what are the benefits. It helped us decide on what database to use in our backend portion of the project.

2   Major Design Decisions

While the group did agree on most of the technologies to use in the project, there was rich debate regarding which architectural pattern to use. Specifically, there was discussion on whether to use a hierarchical design. We decided to use the Model-View-Control architectural style because it increases performance, flexibility, maintainability, reusability, and scalability, while hiding the complexity of distributed processing to the user. We decided to split the presentation layer into 3 different components: Catalog view, the Customer Credentials view, and the cart view. In the business layer we decided to modularize the code by combining the related functions of the system together. In the data tier, we decided to add connections to the database so that we can perform operations on it such as add, delete, update, and read.

3   Use case Diagram

Below is the UML diagram created to show all the use cases covered in the system. It is intended to be a comprehensive diagram which showcases all the intended use cases
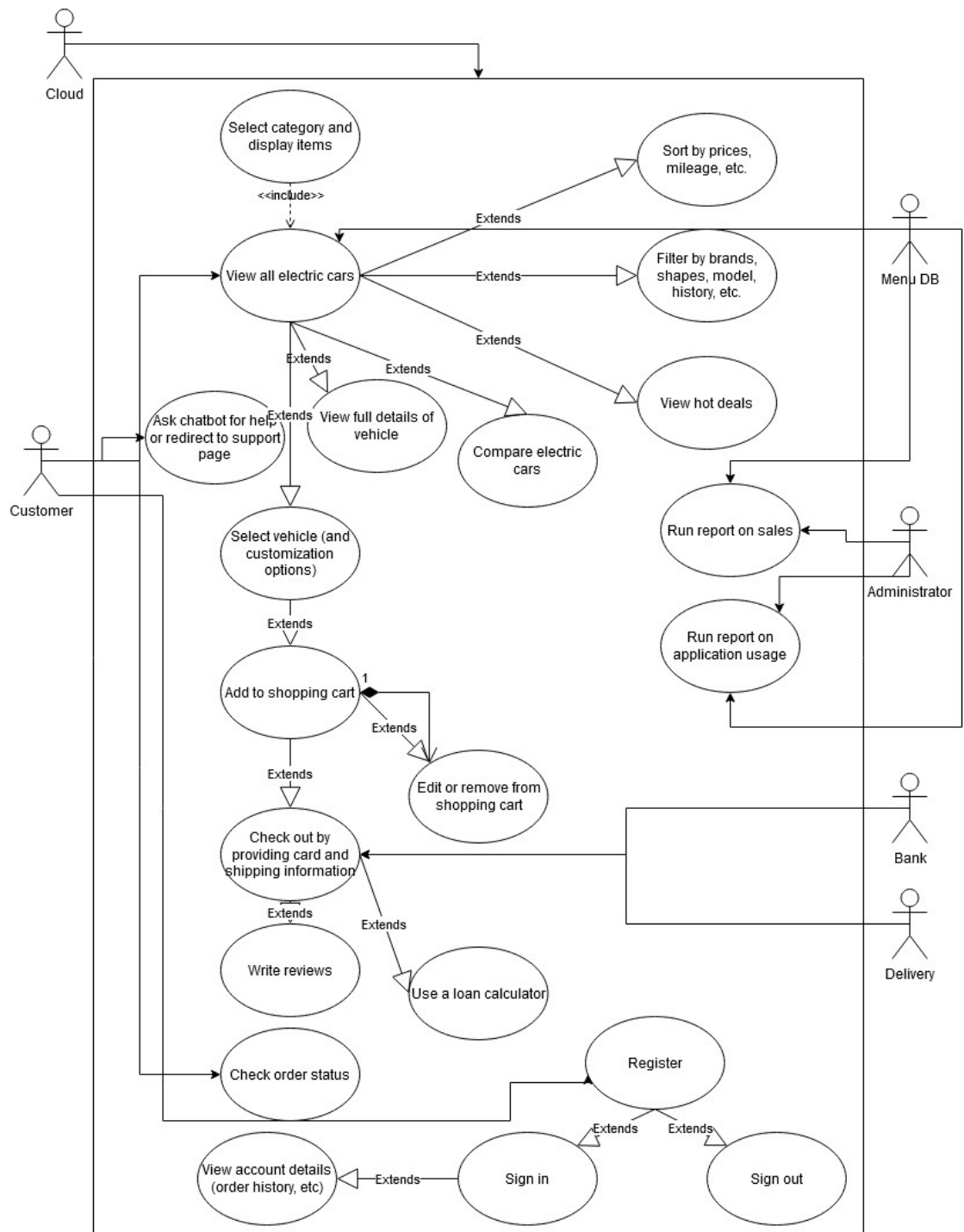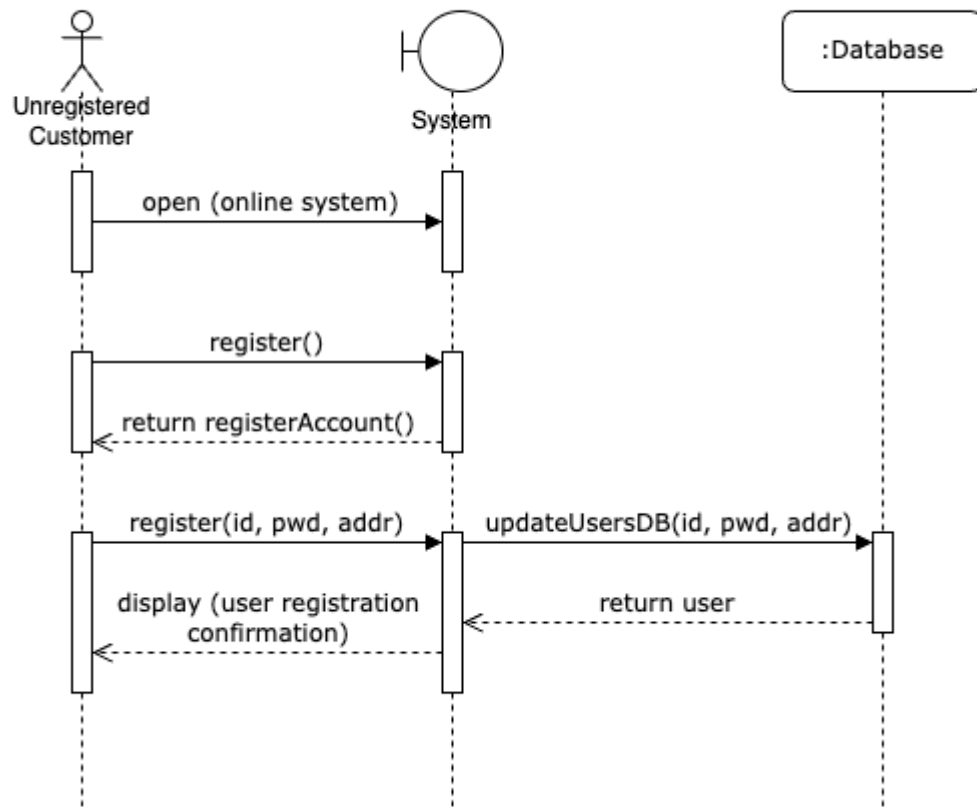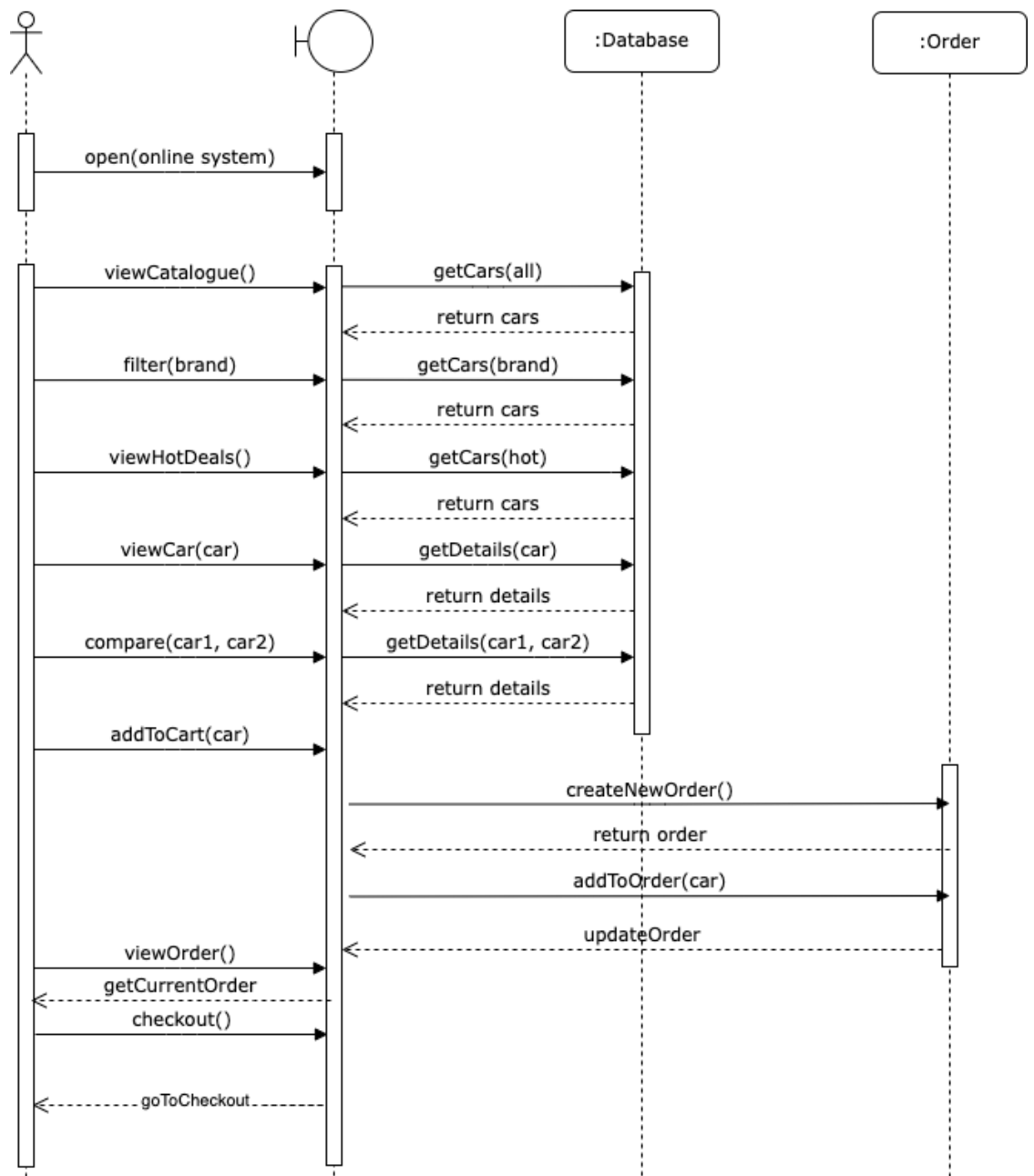
4 Sequence Diagrams

This section covers 3 sequence diagrams which depict use cases in the diagram. The 3 use cases covered are: registering a user, browsing the catalog and canceling an order. The first sequence is registering a customer. Here, an unregistered user would interact with the system to register an account. The system takes the user's request to create an account, interacts with the

database to add a user to the database and returns the final account information to the user.

Sequence 1: Registering a customer

Sequence 2: Browsing catalogue

Above is the second sequence diagram. Here, the user browses the catalog provided to find their ideal car and to create an order. Whenever the user interacts with the system to find their preferred items in the catalog, the system will make a call to the database in order to pull the required data to show the user. Finally, when creating an order the user will create a new order and proceed to checkout.

Sequence 3: Cancelling an order
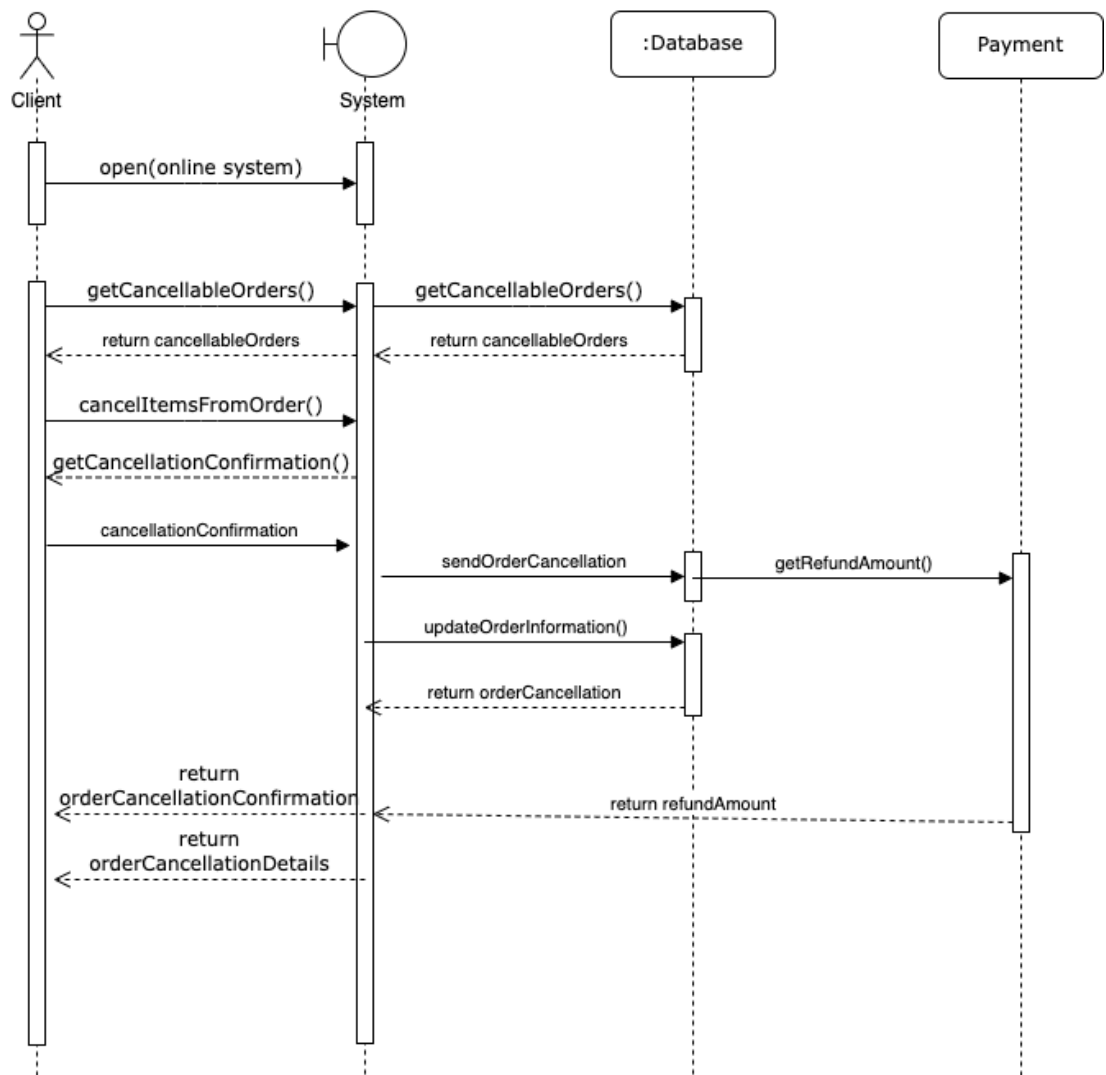
The above diagram shows the process as a user cancels their order. They get their cancellable orders, then after the system gets the confirmation from the user which allows them to delete the order, they delete the order from the database and contact the payment processor to get the final refund amount for the canceled order. This is then returned back to the system to display to the user. This was not implemented in our current iteration, but is a goal for future updates to the s

5   Architecture

Three-tier architecture – Presentation, Business (MVC), Data

Presentation:

- Divide into three main parts: catalog view (shopping), customer credentials (sign in, register, sign out), cart view (add item, remove item, view cart)

- These 3 UI's are shown to the user at different times. When the user views the catalog and and it's full details, they see the "Catalog View". When the user is doing credentials related activities, such as sign-in sign-out or register, they see the "Customer Credentials" view. When the user is at checkout, they see the "Checkout" view

Business:

- The components cover the business control sections.
- The view is updated according to how the logic is updated from the component section.
  - The customer view component changes which cars are shown as well as what car details are shown according to what filters the user applies.
  - The customer component accesses data from the system for logical system use.
  - The login component updates user credentials for the current user according to whether the user signs in, or signs out. Also, a new user is added to the system whenever a user visits the website as well as whenever a new user registers their data.
  - The Cart View is updated as the user adds or removes items from the shopping cart component.
  - The product component has writing and reading reviews, and can be accessed by the shopping cart component.

Data :

- The Data is persisted by the persistence infrastructure.
- The Persistence infrastructure connects via Mongo to the main database called "Menu Database".
- The Security infrastructure uses encryption and access control to secure the system.

| Use cases that registered customers can execute	Use cases that administrators can execute
List electric vehicles available in the catalog	Run Reports on vehicle sales
Sort vehicles by prices (sort electric vehicles based on ascending prices or based on the descending prices) or by mileage (i.e., low to high and high to low)	Run reports on application usage
Filter electric vehicles by brands, by shapes, by model year, by vehicle history (i.e., with reported accidents/damages, and without reported accidents/damages)	
View full details of each electric vehicle (including the vehicle history report if applicable) available in the catalog	

Modules

Module Name	Description	Exposed Interface Names	Interface Description
M1	Catalog view	M1:I1 M1:I2	M1:I1 "viewAllCars()" M1:I2 "viewCarDetails()"
M2	Customer Credentials	M2:I3 M2:I4 M2:I5	M2:I3 "signIn()" M2:I4 "signOut()" M2:I5 "register()"

Interfaces

Interface Name	Operations	Operation Descriptions
M1:I1	<return List<Car>> I1:Op1() used by M2, M4	returns a list of cars for view in the catalog view

M1:I2	M1:I2:Op2() used by M9 <returns List <CarInfromation> I1:Op2()	returns a list of car informations for use in the catalog view
M2: I3	<return Customer > I3:Op() used by M4, M8, M9	returns the customer after the sign in has been completed for use in the other modules
M2: I4	<update database > I3:Op() used by M5	After signout, the user is automatically registered by M5
M2: I5	<return new Customer > I3:Op() used by M4, M8, M9	returns the customer after either registration process completed by user, or user without any login credentials stored in system visits website for first time.

Here, we have two modules: M1, which represents the Catalog view, and M2, which represents the customer credentials view. Within the Catalog view, we find two interfaces: I1, where all cars can be viewed, and I2, where we can see the details of the car. In the customer credentials view, we have three interfaces: I3 for signing in, I4 for signing out, and I5 for registration.
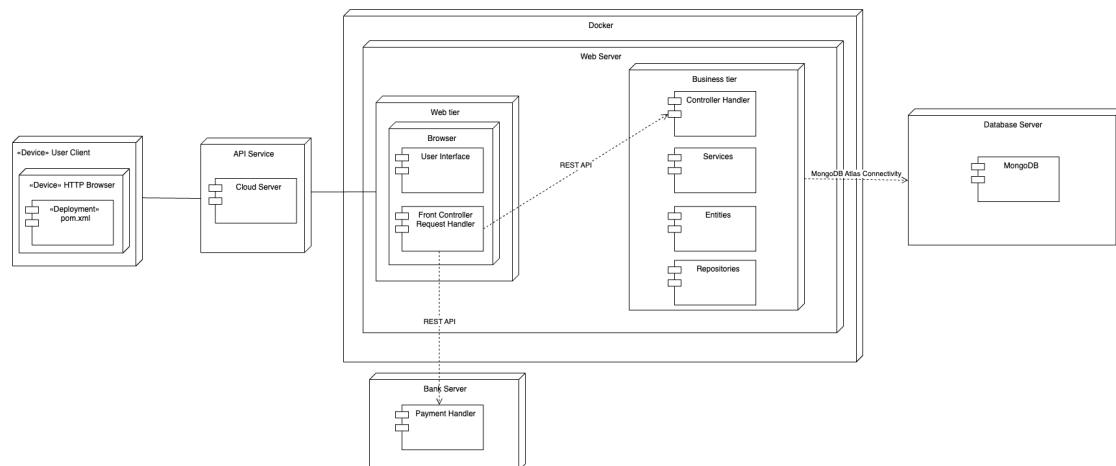
Component Diagram
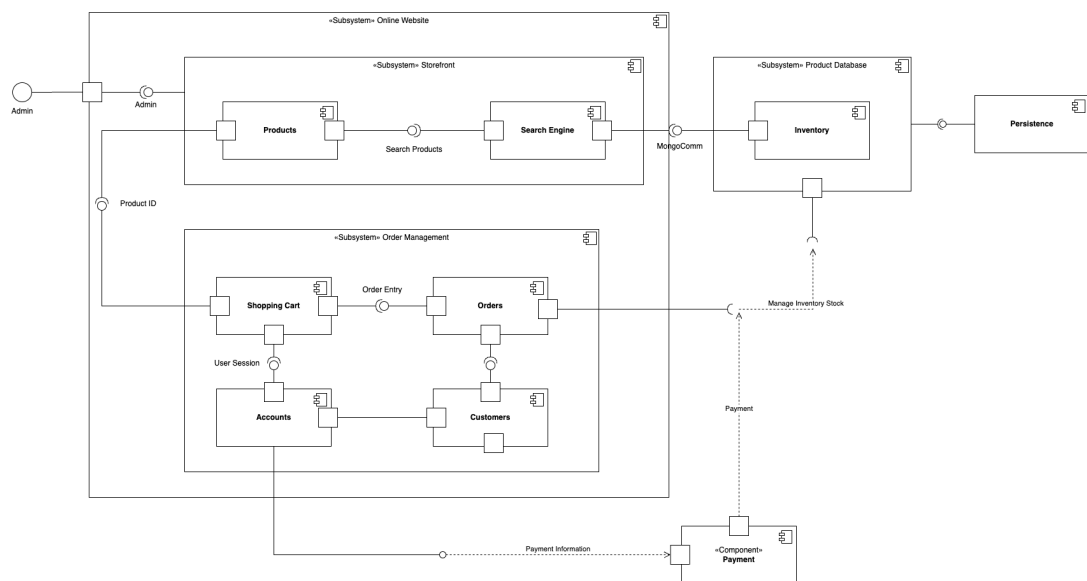
The above component diagram depicts the organization of our ecommerce system. The storefront is a subsystem consisting of what the user clients are seeing and interacting with. This includes the filtering and sorting methods provided through the main page of the products catalog which uses the controller classes in tandem with the service classes to query the backend. These controller classes distribute data gathered from the database through multiple avenues to return the user's requests for products through the frontend. The products are added to the shopping cart through their unique product IDs. Due to their unique ID nature, we also are able to create checkout carts quite easily, including its total amount. Additionally,

the user can check to see if their monthly loan payment upon purchasing the car through our monthly payment calculator. If they are not purchased, they may remain in the user's shopping cart through the user session persistence. These are both stored within the customer's database. Once the order is placed, the product's database is updated with the new inventory count and the payment is completed through the payment gateway connected to the customer's account.

Deployment Diagram

The above component diagram describes the architecture of our application. The User Client is how the User interacts with the website. The User will use their HTTP browser to connect to the application. Docker is used to containerize the Web Service. Then, Render.com is used to host the website, to make it HTTPS safe. The user will use the API service to handle API requests and responses. There are then two parts of the web server: the Web Tier and the Business Tier. The Web tier encapsulates the User interface and the frontend request handler. This ensures that the user does not have control over the backend since the frontend request handler can only request data. The business tier encapsulates the logic and model component of the application. The controller handler includes business logic as well as processes the web tiers application requests. The Services are used to execute specific rules and logics. Entities are models which are used in the application. Repositories interact with the database and are responsible for storing and accessing the data. The bank server component has a PaymentHandler which deals with payment processing. The Database Server is hosted on MongoDB Atlas and is connected through MongoDB connectivity.

Design patterns:

For the design patterns we decided to use Observer, Singleton and Factory.

Observer pattern: Since Observer pattern works perfectly for defining one-to-many dependencies between objects, and also notifies and updates all of its

dependents automatically, we thought it would be a good idea for us to use this pattern for our e-commerce systems for handling the situations such as changes in the inventory, changes in the cart, order status changes or inventory updates. Also, using the Observer pattern helps us maintain a clear separation of concerns which leads to reducing the security risks and scalability. This was then implemented within our multiple controller classes to observe their own special files.

Singleton pattern: We thought Singleton pattern would fit well in our E-commerce system for things like managing our shared resources, memory caches or global configurations since Singleton pattern allows us to have only one instance for a class and provides a global point of access to that instance.

Factory pattern: The database adds multiple objects created through the entity classes in a Factory pattern. This is extremely useful for scaling and reliability since the classes are able to obtain commonly required attributes easily. This also helps abstract object creation as required. We created multiple model entities, which served as object creation classes in our project.

JEE patterns

Presentation pattern: For the presentation tier, we wanted to use the Front Controller pattern. This is because the front controller allows for a single, centralized point of request handling making it easier to manage all user requests. All the incoming requests will be handled by a single handler acting as the initial contact point, and then passed to the corresponding proper handlers where the requests will actually be fulfilled. This mechanism allows us to have a clearer view of the flow and navigation through our system. Having the front controller is also beneficial for managing and reducing code as there is less duplication across the different responses for handling each request. This makes the behavior for each request handler more easily maintainable as the code is not scattered, with the logic being in a centralized location, allowing for changes to be made in fewer places. However this was not able to be completely implemented in the final product. This is because we were still testing the code and thus were testing with multiple controllers. Due to this, the submission includes multiple controllers instead.

Data tier: For the data tier, we decided to use the Data access object pattern. The Data Access Object (DAO) separates the data-accessing to the database, such as obtaining and storing data, from the clients by abstracting the underlying data access implementation into a separate layer. By doing this, the data-persistence logic is hidden and the client is unaware about how the operations regarding the database are implemented. This allows for our system to be loosely coupled in regards to the business and data components, as well as centralizing all the data access points, making any changes we may need to perform later on easier to manage and maintain. Another big advantage of this was that the DAO pattern

makes it easier to transfer to different database implementations. If we were to have problems with our current database, it would be a simple fix to change to a different database as we would only need to make changes to the DAO layer instead of rewriting our entire application. To implement this, we used multiple repositories in Spring Boot, which acted as specialized DAO for our backend components.

Business tier: For the business tier we decided to use the service locator pattern in our E-commerce system since it lets us centralize the process of obtaining a service with a centralized registry. We thought this would be appropriate specially to manage and locate different services like payment processing, shipping or inventory management. This would give our program the flexibility to manage the business tier better, make it easier to maintain and update the system and improve the testability and scalability. We use our controllers to access certain service controllers and use multiple services to aid in finding and accessing data from the database.

Architectural patterns

One architectural pattern we decided to implement was REST. One reason why is due to the fact that the client and server implementations can be modular and separate. This allows us to freely make changes to either side without any concerns of how it may affect the operation of the opposite side. Both sides are thus not reliant on each other therefore allowing for good performance for availability and scalability. This made it easier for us to implement our system as we divided our work into either client and server sides and we would be able to freely develop our work independently of each other.

Along with the REST architectural style and the front controller design pattern, we also have the possibility of implementing the API gateway as the one single access point to the rest of the application.

We also decided to implement microservices to further break down our application into smaller components. This helps to further organize our system as each component would be independent from the others, and therefore can be updated or expanded upon without affecting the functionality of the rest. As a result of this, it also helps to ensure loose coupling between the components. Breaking down our services into smaller components is also beneficial as each component has its own focus on solving a particular problem, making testing and debugging easier for us.

For the structure of our system, we decided to go with the three tier architecture (presentation, business and data) and to incorporate the Model-View-Controller pattern within it as well. This is because this helps provide a separation between the different components within the tiers allowing for easier organization of the code and therefore maintenance as well. The similar actions are grouped together all resulting in separating into different components, resulting in coupling.

Quality Attributes

Security: One way our system implements security is through the use of authentication and authorization to ensure confidentiality, integrity, and availability. Users have the option to create an account with our system with their email and a password. This is used to authenticate the customers as they are required to sign in with this information in order to commit any financial transactions. If users are not signed in, then they are unable to access the majority of the site since users are not able to identify themselves. Customers accounts differ from administrators accounts which will be authorized to see private or sensitive information about the system and the database, such as the repository of inventory. However, they will not be allowed to view customer financial data unless absolutely necessary and this access will be logged to align with safe practices. This will further ensure the confidentiality of the customer's information as well as the integrity of the system and database. Each transaction that a user makes on the system is also documented into the database as we have a table in the database for the shopping cart and final orders of each user. With this, we have the ability to prove that a user made such transactions on our system. As we have published the site on Render.com, they are able to secure our deployment to the web, as all data passed to the site is encrypted through HTTPS and the SSL certificate.

Prevention of attacks: In order to prevent certain web application security risks, countermeasures were enforced. In order to prevent cross-site scripting (XSS), we employed the unique features of Spring Boot . This was also implemented for quotation marks. Another countermeasure would be that any script inputs received from the input fields are not to be persisted. Quotation marks were also used to surround any variables in order to prevent any changes to the context therefore preventing XSS attacks. We also made sure to hardcode any variables that were acceptable by JavaScript, such as onClick() to prevent any untrusted values from getting through. We used MongoDB's built-in functionalities which help with building secure queries without the use of JavaScript.

Usability: Throughout our system, for each HTML file there is a subsequent JavaScript file that provides validations to handle any user inputs. This helps to improve the usability of the system as it provides user error protection, alerting the users if there are any errors or such.. For example when registering an account, the system will let users know if the passwords do not match or if the inputted email is invalid, etc. This helps with the users needs as the system lets them know exactly where the issue is, allowing them to finish their task easier. This check is also done in the during checkout, especially when inputting sensitive data such as credit card information and addresses. Additionally, we ensured that every password field was given the password case so as to increase the security of the user's password. The system was also made to be very simple with a simple and clean design for clear navigation as well as basic operations to prevent over complicated processes. Since the prospective user;s can have varying levels of e-commerce literacy, we felt this was the best way to ensure that all customers were given an amazing

shopping experience. These design decisions were made to enhance user experience as users are able to use the system with ease and flexibility.

Maintainability: Due to implementing microservices as well as many different design patterns (such as DAO) and architectures (MVC, 3 tier architecture), we were able to develop a system that has high cohesion and low coupling. This allows for better maintainability as well as scalability as the various modules in our system are independent of each other, and while working on one component we would not have to worry about other components being affected by its development. This allows for the different components within the server and client side of the system to be able to grow independently from each but all while at the same time. This also helped with creating reusable components allowing for the code to be cleaner and therefore more maintainable. Breaking our code into components also helps with identifying which components needed to be fixed which helped during testing as well as if we need to scale up certain parts of our system. To improve maintainability, we should change the frontend from a HTML and JavaScript frontend to a React JS frontend to allow for better scalability and maintainability.

Performance: To ensure that our website has peak performance, we performed consistent performance testing throughout the development process, including REST API performance testing. Along with this, many design patterns and interfaces were included in our design in order to help with our performance. For example, using Spring Boot with MongoDB allowed us to use highly optimized queries. This helps to present a dynamic and interactive design to the client and also speeds up the response time. Users do not have to wait for constant reloading of the whole page, rather only the information that they are looking for is updated. Implementing microservices also helped with performance as all our functions were broken down into smaller components. With this, it was easier to understand and manage each component, also making it easier to scale up in the future.

Description of the Server Side Implementation

For the server-side implementation, we use Spring Boot which acts as the controller in MVC and MongoDB Atlas for our database. We thought using these two would be a solid choice for building robust and scalable microservices following REST principles. Furthermore, using MongoDB would allow for easy scalability when deploying the application on the cloud.

To deploy the website, we decided to use Docker to create a containerized version of our website and then deploy it on render.com. This approach is efficient since it allows consistency across different environments and simplifies the deployment process. Using this approach also makes it easier to manage, scale and deploy our website. It is

also a very simple process, which any team member can follow, allowing for quick uploads of test builds. Render.com simplifies the deployment process with its platform that supports various types of applications. It also provides easy scalability. Once the deployment was completed, Render.com provided us with a unique URL for our website, which accessing to it verifies that our containerized application is running successfully in a production environment. MongoDB Atlas allows for easy integration with Docker, which is the technology that we used to deploy our application on the cloud which eases the development and maintenance process. Furthermore, MongoDB has an excellent query language which allows for powerful querying such as searching text which is beneficial for us since it can allow for fast querying. MongoDB also has encryption while the data is being transported from the front-end to the back-end which would further improve the security of the application. Also, since MongoDB is a NoSQL database, it gives us flexibility in our data modeling which leads to scalability. We decided to use MongoDB since it is cloud-based and can provide us with high availability, scalability and security.

Spring boot acts as the controller in the MVC architecture. It facilitates rapid development, provides a comprehensive set of tools and simplifies the configuration. Spring Boot inherently supports the RESTful APIs which leads to Spring Boot to be our choice to implement the REST principles. Spring Boot handles the complex configuration tasks when creating REST services while also simplifying common tasks. For example, Spring provides us with annotation services which give us the ability to help define Restful endpoints which simplifies the process of defining API endpoints significantly. Spring Boot also gives us the ability to support statelessness in the RESTful APIs. Furthermore, using HTTP methods such as GET, POST, PUT and DELETE properly, leads us to properly following the REST principles.

MVC architecture was used to implement our e-commerce system and it represents the data model and is mapped to MongoDB. Its controllers handle the incoming HTTP requests, interacts with services and returns the appropriate responses. The repositories we used provide us with an interface with the MongoDB database, leading to a high-level abstraction for data access.

In our project we separated our application into entity classes, their controllers, and their services which follow REST principles. Entity classes represent the structure of the model i.e. a resource that our application will be using. Controller classes handle incoming HTTP requests and the data that comes with it as well as defining operations that will be done on the data. They are also responsible for invoking the operations associated with the incoming HTTP request. The service layer acts as the middleman between the controllers and data access layer. For example, in our application we

developed the User entity class. The user entity class defines the structure of the user data.
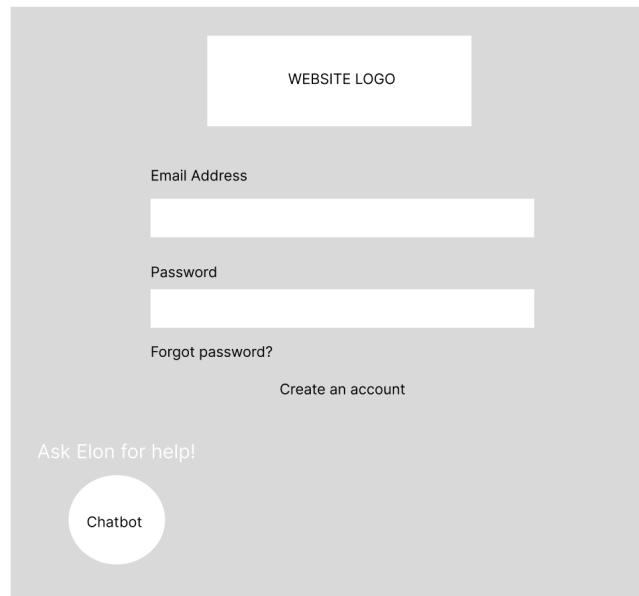
There are 3 microservices developed: CustomizationService, ProductService, and UserService. CustomizationService had multiple bugs and the code was removed, but it was meant to query availability for customization options, and add customized cars to cart, but was not able to make final submission. ProductService is used for adding products to the database and finding all the products in the database. UserService is used to provide specialized services related to user credential activities. It creates, and finds users.

Initial thoughts on Chatbot Implementation Technologies

Initially, the technologies we were planning using to implement the chatbot were: Amazon Lex. Amazon Lex would be able to integrate nicely with AWS which is a technology that we would be using to deploy our application on the cloud. A chatbot framework such as Amazon Lex can help build the conversational flow and handle the user interactions. While we did discuss training our own chatbot due to new technologies allowing for accessible and effective training options, we decided on using Amazon Lex instead since it would be much more accessible to work with and it integrated very well with AWS technologies.

Description of the Web Design

For our web design, we decided to prioritized usability therefore our main goal was to make our web page simple, clean, and easy to use. This is so the clients are able to navigate freely and easily through the website and do not run into any issues that may deter them from using our services. The figma's were created as a reflection of what our ideal design should be like, but due to time constraints we were unable to fully implement the designs. While keeping most of the function elements, they lack the efficient UI that is depicted in the diagrams.

WEBSITE LOGO

Email Address
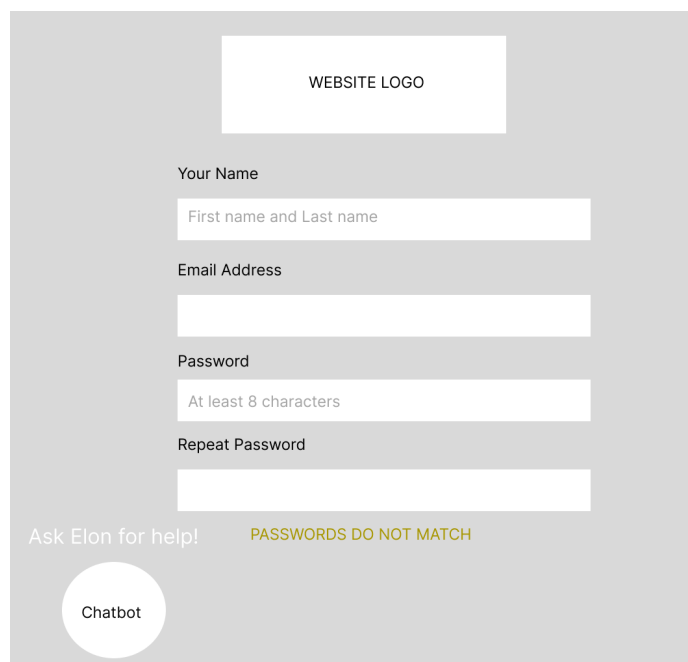
Password

Forgot password?

Create an account

Ask Elon for help!

Chatbot

For our login page, we went with a simple and generic layout where the email and password are displayed in the center of the page. This is to increase familiarity for the ser while they perform a very important operation. Under the password, we have a password reset button to help users if they forgot their login information. Underneath that we have an option for users to register an account if they do not have one with our system yet. We have the chatbot option on the right for if the users run into any issues.

WEBSITE LOGO

Your Name

First name and Last name

Email Address

Password

At least 8 characters

Repeat Password

Ask Elon for help!   PASSWORDS DO NOT MATCH

Chatbot

Just like our login page, we chose a simple layout where the name, email, password and repeat password are displayed in the center of the page. If the password and the repeated password don't match, an error will be displayed on the bottom of the page, which lets the user know their passwords don't match and they have to retype either password or repeated password to make them match. We also have the chatbot option on the bottom left just in case the users run into any problems.
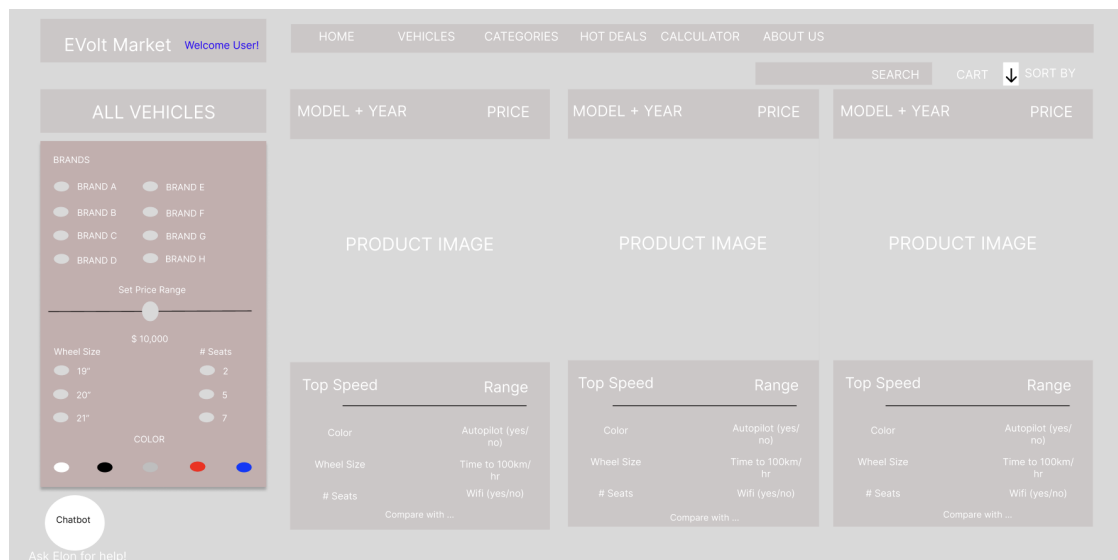

All of the main pages for our system, such as the hot deals and the listing of all vehicles, were listed at the top of the page for easy navigation for the users as they are presumably the most visited pages. When the user is logged in, their name would be displayed where the welcome statement is placed to add in a touch of personalization and invite in the users. The filtering bar is always present on the left side of the page so the users are easily able to access it and find their desired products quickly. The box consists of all the possible customization options as well so the users are able to specify exactly what they want. Below the filtering bar is the chatbot option where users can ask for extra information or help. This is always present on all pages as we want to be able to provide extra information and services at all times. The primary focus of the page would be where the products are displayed, on the right hand side of the web page. Here, each product of the website is displayed along with its product information. Above the product section is where users can click to view their current cart items or search for products. There is also an option to sort the current products shown. At the bottom of each product listing, there is also an option to compare the selected product to another. To view the full description of the product, users would click on the product listing.
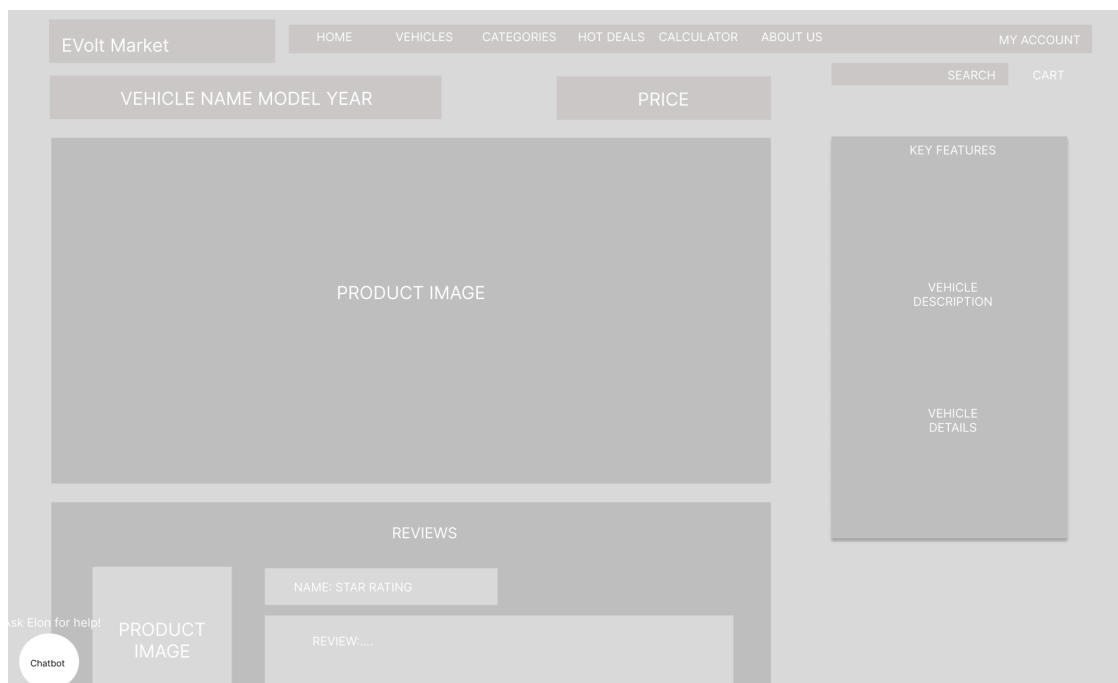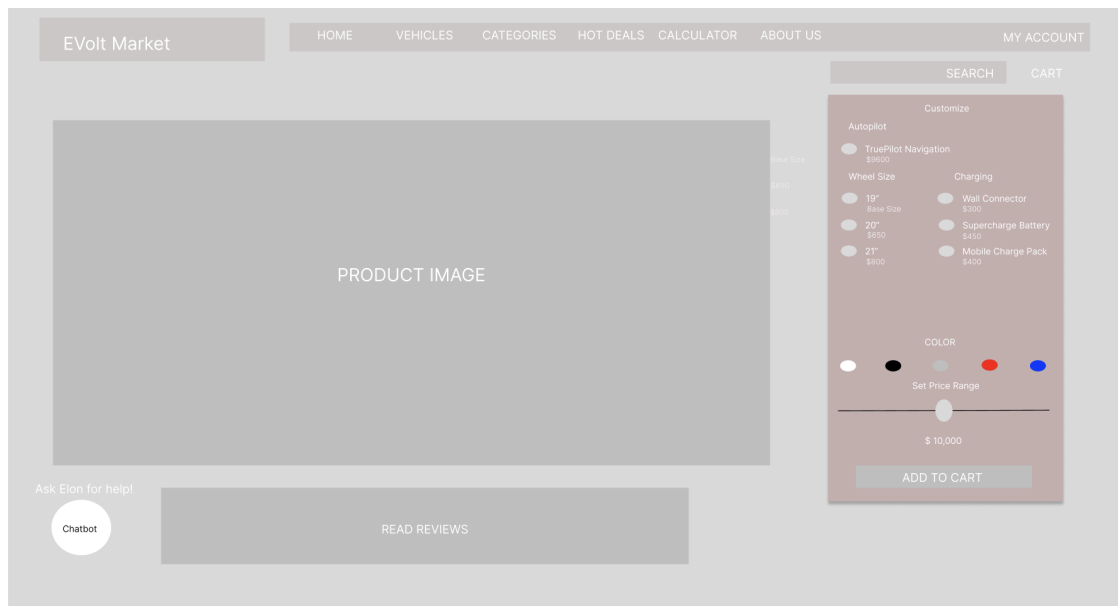
For the product page, we display the image of the product corresponding to the current customization options selected from the right hand side. This customization box consists of all possible customization options that the vehicle offers. At the bottom of the box is the option to add the current vehicle with the customizations selected to the cart. As the user scrolls through the product information, the vehicle description as well as its features and details are showcased at the right hand side, following the customization options. At the bottom of the page, the reviews for the product are shown.
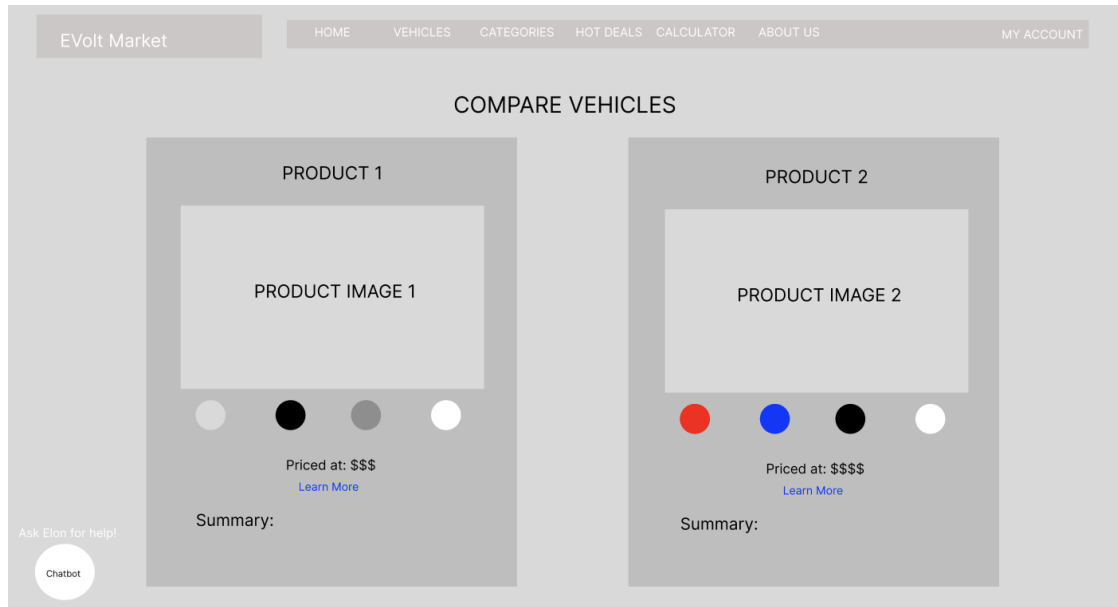
When comparing the vehicles, users are shown the images of the two products along with the physical customization options to allow for comparison of appearances. Below this is a summary of the key features of each vehicle side by side for a direct comparison.
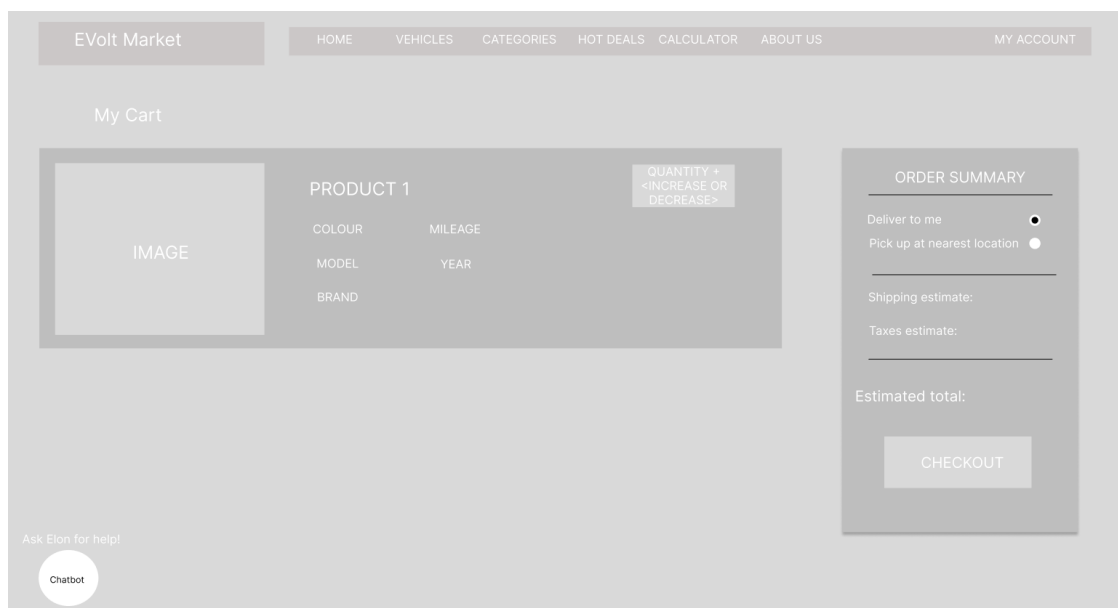
Inside the cart, users can view all the products added along with a summary of the price of their total order. Inside the summary is included an estimate of the taxes and shipping costs if they choose to have their order delivered to them. Users also have the option to increase or decrease the quantity of the product they wish to purchase.
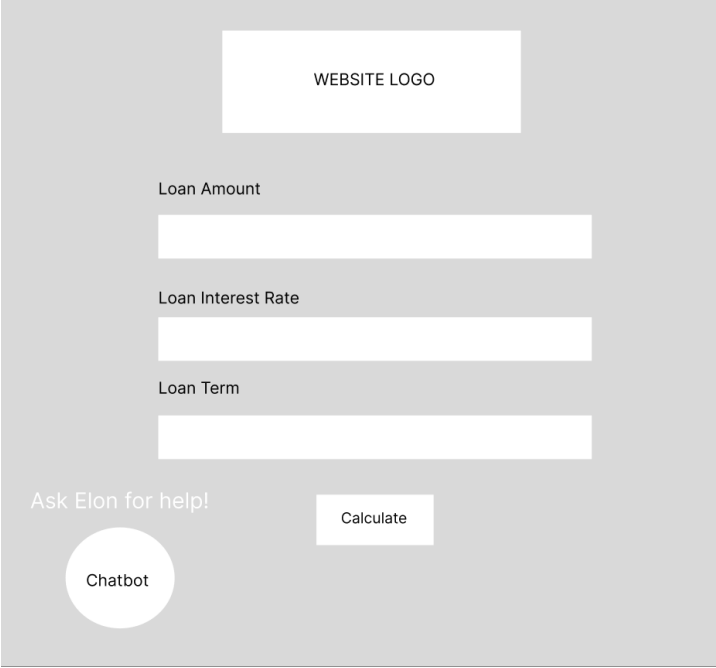
For both the payment and the shipping window, we have the bar on top containing the home, vehicles, categories, calculator and about us buttons. For the shipping detail window, customers are able to see a picture of the car they are purchasing, alongside with its name, price and features such as color, model, brand, year and mileage. Below this box that contains information about the product which the customer is purchasing, there is some information for the customers to complete such as their name and last name, street address, city, postal code and cell phone number. The customer can also choose to save this information to their address book and/or set it as their shipping address. The customer then chooses their shipping method which means they can

choose whether they want standard, express or priority delivery. On the right side of the shipping address window the customer can see a window containing the order summary and a button that after clicking it, they can proceed to checkout.

For the payment method window, the customer chooses the method of payment and whether they want to do it through visa, mastercard or paypal. They also provide their card details such as card number, name on the card, cvv, mm/yy , city and province. The customers can then choose to save the payment method and/or set the current method payment as the default payment method. On the right side of the payment method window, the user can see their order summary, the cost of their product, its tax and order total. There is also a button where by pressing it, the customer can review their order and submit the payment. In both the shipping information window and the payment method, we have the chatbot button just in case the customer has any questions or needs help with anything.

WEBSITE LOGO

Loan Amount

Loan Interest Rate

Loan Term

Ask Elon for help!

Calculate

Chatbot

For the Loan Calculator page, there are 3 boxes stacked on top of each other in the middle of the page for the user to put the loan amount, interest rate and term in them. There is also a calculate button below these boxes which will calculate the monthly payment for the information that the user provided. There is also a chat button available on the bottom left side of the page so that users can ask any questions they might have if needed. The logo of the website will also be shown on the top middle of the page.

For the Account detail page, the users will see the tab containing home, vehicles, categories, hot deals, calculator, about us and the account buttons. The users can see or edit their account information or their shipping address information. The account information section contains the name, last name and email and an edit button.

Below the account information section there is shipping address information containing first and last name, street address, city, province, postal code, country and cell phone number. There is also an edit button for this section. The chatbot button is also provided in case the user needs help with anything or has any questions.
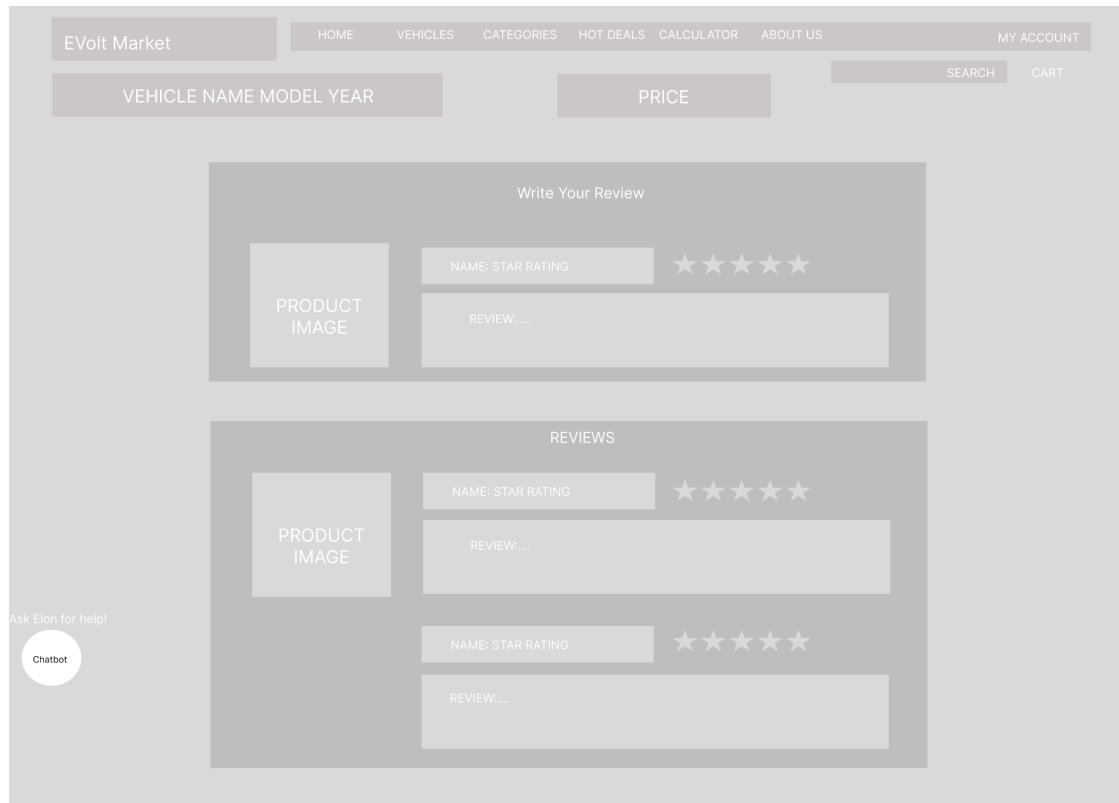
For the review page, the hot deals and the listing of all vehicles, calculator and about us pages are listed at the top of the page. When leaving the review you can see the vehicle name, model, year and price on the top of the page. There is a review box which contains input boxes where the user writes their name and review in. The user can also upload the picture of their product if they want. The user also can rate the product from 1 - 5 stars.

Underneath this box there is another box that the user can see the reviews written by other users, the star rating and the picture of their product if available. There is also a chatbot button available for the users in case they need to ask ant questions or have any confusion.

Description of the Client-Side Implementation

Initially, we wanted to implement a frontend using React JS. This would have been a quick and effective way to port our existing HTML and Javascript files over to a framework which allowed for much better scalability. However, due to time constraints this was scrapped to instead ensure that the most features as possible were implemented during the development.

Inorder to implement the client-side we used the following technologies:

HTML(Hypertext markup language) was used to create the structure of our E-commerce website. It was used to define the elements that were used on our website such as user input, buttons, texts, paragraphs, headings, drop down menu, lists, search tab and so on.

CSS(Cascading style sheet) was used to style the HTML elements and to define the layout of our E-commerce webpage. It was used to improve the visuals of our website and change aspects such as the font, font size, background and its color, margin and paddings and any other visual elements of the website.

JavaScript was used in order to extend the functionality and add in dynamic behavior to the HTML code. This was achieved through the addition of responses to user events with the DOM (Document Object Model) API. A prime example of this would be through the validations of the user inputs in the signup page. If a user were to leave any of the fields blank, then the javascript function would alert the user with a message stating that all fields must be filled. Another example would be if the passwords were not matching or the email inputted was not valid, the client would receive a message notifying them of their errors that needed to be fixed before they could proceed. JavaScript was also used for other DOM events such as the on-submit event in order to dynamically update data. This was done through functions defined in the javascript file and assigned as the action for the HTML file.

We can quickly change the content to show only what the customer desires without having to reload the entire page as nothing else on the page needs to be adjusted. XMLHttpRequest objects would be used in order to retrieve data from the server as well as across the network.

RESTful APIs were used to communicate with the server in order to fetch and send data between the client and server.

Github was used to let all the teammates collaborate on the project, update and make changes in the code, or save their version of the code more efficiently.

Technologies Used for chatbot

 The technology that we decided to use for the chatbot feature of our website is "LiveChat" since it is an efficient tool to provide real-time support and engage with the website visitors. "LiveChat" is a customer service and online chat platform that allows businesses to connect and interact with their customers who visit their websites

in real-time. In order to use this feature, first we needed to integrate the LiveChat software into our website; so in order to do so, after creating an account on the LiveChat website, we adjusted the settings, agents and conversations that we needed for our website and modified the customizations such as color and other visual elements of our chat widget, so that it matched the aesthetics of our E-commerce website. In the LiveChat dashboard, there was a section which generated a unique snippet code for our chat widget in JavaScript. So to incorporate the LiveChat chat widget in our website, we copied the code that was generated for our website by LiveChat and pasted it into our project's HTML. After we saved the changes into our website and published it, the LiveChat widget got activated on our website. So when a user visits our website, their browser loads the webpage and executes the JavaScript code that is provided by the LiveChat service. After clicking on the chat widget to start a conversion, when the user sends a message and initializes a chat, the chat widget sends a request to the LiveChat service's servers. The LiveChat service's servers then receive these requests, process them and manage the communication flow between the user's browser and the back-end. Simultaneously, the chat messages get sent to the LiveChat agent dashboard where the customer support or the people who have access to the website can monitor and respond to the messages. The customer data, chat transcripts and other relevant information are stored and managed on the LiveChat service's server. This process of interaction between the user and the LiveChat chatbot, involves a continuous exchange of data between the user's browser, the LiveChat service servers and the agent dashboard. The communication happens through a combination of frontend and backend technologies.

Demo Section

Feature to test/check during the demo (35% of Deliverables 3)	Mark	Comment made by the TA/prof
1) The system is cloud-native (4%)		
2) It is possible to register (2%)		
3) It is possible to sign in (2%)		
4) It is possible to sign out (2%)		
5) The system is secure (e.g., the system is using https in its url) (3%)		
6) It is possible to filter items (2%)		

7) It is possible to sort items (2%)		
8) It is possible to add items in the shopping cart (2%)		
9) It is possible to remove items from the shopping cart (2%)		
10) It is possible to check out items (2%)		
11) It is possible to write reviews on items and rate items using five stars (2%)		
12) It is possible to use the distinguished feature (2%)		
13) It is possible to use the chatbot (3%)		
14) It is possible to use the loan calculator (3%)		
15) It is possible to view hot deals (2%)		

Strengths and weaknesses of the project

Strengths:
1) Included product reviews and ratings so that users can make informed decisions when purchasing cars.
2) We included security measures such as HTTPS which ensures the privacy of the user.
3) Our database is quite scalable considering we used MongoDB which is a highly scalable database and has high performance as well.
4) We were able to correctly implement the backend using Spring.
5) We have an efficient shopping cart and checkout process which helps with streamlining the purchasing process.
6) Our overall application operates quite fast.

Weaknesses:
1) Our application doesn't have an appealing user-interface which decreases the overall purchasing experience.
2) Our application doesn't have images for the products.
3) There is no implementation for the administrator functionality so we cannot run the usage tests or analytics.
4) There is no car customization implemented.
5) We weren't able to sign out unless they clear the cookies.
6) The loan calculator does not show current price
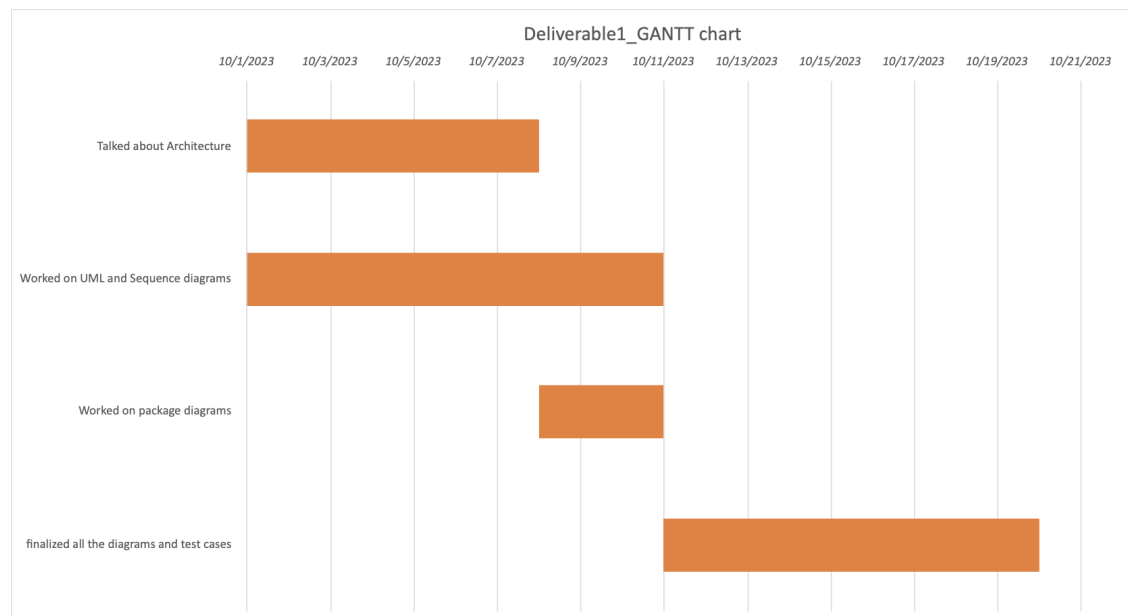7) Checkout does not show the current cart price

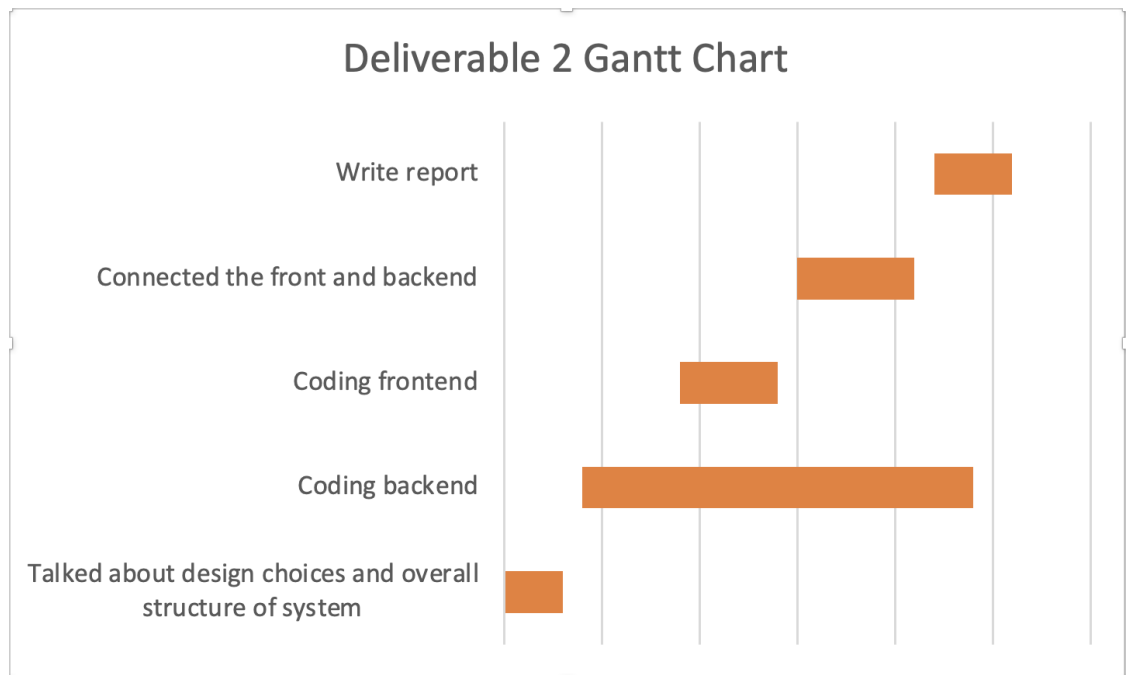8) The system isn't very scalable since the front end hasn't been implemented.

What did we like in the pro

We really liked how we learned how to implement multiple different technologies in one project. It helped us understand a lot more about how e-commerce systems are created and how they are scaled up, as well as how important building scalable infrastructure is. We also learned how challenging it was to build a full end-to-end application and overall it was enjoyable.

6   Activities Plan

6.1   Project Backlog and Sprint Backlog

Deliverable1_GANTT chart

Task	Timeline
Talked about Architecture	10/1/2023 – 10/8/2023
Worked on UML and Sequence diagrams	10/1/2023 – 10/11/2023
Worked on package diagrams	10/8/2023 – 10/11/2023
finalized all the diagrams and test cases	10/11/2023 – 10/20/2023

Deliverable 2 Gantt Chart

6.2   Group Meeting Logs

Present Group Members	Meeting Date	Meeting Time	Issues Discussed / Resolved
Celina Su, Manasvi Jain, Sara Soleymani	Oct 1, 2023	10:30 AM - 4:00 PM	Discussed the architecture of our E-commerce system, talked about the use cases for registered customers and administrators, discussed ways to draw our UMLs
Everyone	Oct 8, 2023	4:00 PM- 7:00 PM	Agreed on uml, talked about sequence diagrams, split tasks
Everyone	Oct 11, 2023	8:00 PM - 10:30 PM	Talked about the diagrams we made and made changes in them
Everyone	Oct 20, 2023	90 minutes total	Finalized report detail
All members	Oct 24 2023	3PM-7PM	Reviewed the project outline and discussed issues with deliverable 1. Split up tasks for deliverable 2 and started coding.
All members	Nov 2 2023	7PM-8:30PM	Discussed the the design choices for deliverable 2 and updates for our code for the backend and started front end

Celina Su, Manasvi Jain, Sara Soleymani	Nov 12 2023	11:30AM-4PM	Discussed updates about our code and problems we encountered and what to do to resolve it (ran into an issue with springJPA. Continued to work on our code for back and front end.
All members	Nov 16 2023	5:30PM-7PM	Decided to switch to MongoDB. Continued to work on our code and the report.
All members	Nov 25 2023	7:00PM-8:00PM	Discussed updates about our code and split the tasks that were left to do.
Sara Soleymani, Celina Su	Dec 2 2023	2 hrs	
Manasvi Jain, Nolan Lobo	Dec 6, 2023	Full Day	Worked on finalizing report and completing the backend as well as frontend code as much as possible.

7   Test Driven Development

Test cases will be provided in the form of a table as follows:

Test ID	1
Category	Evaluation of User credentials stored on database
Requirements Coverage	UC14- Successful-User-Login
Initial Condition	The user has signed up previously
Procedure	1. The user selects login 2. The user provides a user name

	3. The user provides a password 4. The user logs-in into the system and is presented with the main UI window
Expected Outcome	The expected outcome of the test case (*e.g. the login form closes, and the user is presented with the main UI window*)
Notes	The user should provide only alphanumeric usernames

Test ID	2
Category	Evaluation of the checkout feature Which part of the system is tested (*e.g. evaluation of user credentials stored on file or DB*)
Requirements Coverage	UC11- Successful-Checkout
Initial Condition	The system has been initiated and runs Initial conditions required for the test case to run (*e.g. the system has been initiated and runs*)
Procedure	1. The user selects checkout 2. The checkout UI shows up with all the products in their cart 3. The user enters their credit card information 4. The user enters their shipping information 5. The checkout is successful after verification of credit card information. 6. After checking out the user is presented back to the main UI.
Expected Outcome	The checkout page closes and the user is presented with the main UI window. The expected outcome of the test case (*e.g. the login form closes, and the user is presented with the main UI window*)
Notes	

Test ID	3
Category	Evaluation of the register feature Which part of the system is tested (*e.g. evaluation of user credentials stored on file or DB*)
Requirements Coverage	UC13- Successful-Register
Initial Condition	The system has been initiated and runs. The user doesn't exist in the database Initial conditions required for the test case to run (*e.g. the system has been initiated and runs*)
Procedure	1. The user selects the login page

	2. The user enters their information (email address, first name, last name)
	3. After registering the user information is added to the database
	4. The user is taken back to the sign in page where they sign in and taken to the main UI.
Expected Outcome	The register page closes and the user is presented with the main UI window. The expected outcome of the test case (*e.g. the login form closes, and the user is presented with the main UI window*)
Notes	Any other notes you may want to add for this test case, which are also reflected in the requirements specification (*e.g. the user should provide only alphanumeric user names and passwords without any special characters*)

Test ID	4
Category	Evaluation of the loan calculator feature Which part of the system is tested (*e.g. evaluation of user credentials stored on file or DB*)
Requirements Coverage	UC6- Loan Calculator
Initial Condition	The system has been initiated and runs Initial conditions required for the test case to run (*e.g. the system has been initiated and runs*)
Procedure	1. The user selects the loan calculator feature 2. They are taken to the loan calculator page 3. They are allowed to enter the loan amount, loan term, interest rate, compounding period, and the payback period. 4. The final calculation is presented on the page
Expected Outcome	The final calculation is displayed on the page The expected outcome of the test case (*e.g. the login form closes, and the user is presented with the main UI window*)

Notes	Any other notes you may want to add for this test case, which are also reflected in the requirements specification (*e.g. the user should provide only alphanumeric user names and passwords without any special characters*)

Test ID	5
Category	Evaluation of the Filtering feature
Requirements Coverage	UC3- Successful-Filter
Initial Condition	The system has been initiated and runs Initial conditions required for the test case to run (*e.g. the system has been initiated and runs*)
Procedure	1. the user selects the filtering feature 2. the user chooses a feature for the filter 3. the features are filtered
Expected Outcome	the information shown on the window is filtered based on the features that user chose
Notes	

Test ID	6
Category	Evaluation of Adding vehicles to the shopping cart
Requirements Coverage	UC10- Successful-Add
Initial Condition	The system has been initiated and runs Initial conditions required for the test case to run (*e.g. the system has been initiated and runs*)
Procedure	1. choose the vehicle 2. press the add to cart button 3. vehicle is added to cart
Expected Outcome	the vehicle is added to cart
Notes	

Test ID	7
Category	Evaluation of editing or removing vehicles from the shopping cart
Requirements Coverage	UC11- Successful-Edit
Initial Condition	The system has been initiated and runs Initial conditions required for the test case to run (*e.g. the system has been initiated and runs*)

Procedure	1. choses the vehicle from the cart 2. press the editing or removing button 3. the item is edited or removed from the cart
Expected Outcome	the vehicle is edited or removed from the cart
Notes	

Test ID	8
Category	Evaluation of Asking questions from a chatbot to get answer of basic questions and help customers navigate to a specific vehicle or support page
Requirements Coverage	UC17- Successful-Chat bot
Initial Condition	The system has been initiated and runs Initial conditions required for the test case to run (*e.g. the system has been initiated and runs*)
Procedure	1. the user presses on the chatbot button 2. the chatbot window opens 3. the user asks a simple question and presses the button 4. the user gets the answer from the chatbot 5. the user closes the chatbot
Expected Outcome	the user successfully opens and closes the chat bot and gets the desired answers to simple questions that they ask
Notes	

Test ID	9
Category	Evaluation of the compare vehicles option
Requirements Coverage	UC7-Compare vehicles
Initial Condition	The system has been initiated and runs.
Procedure	1. The user selects the first car 2. The user selects the second car 3. The user presses "compare vehicles"
Expected Outcome	A list detailing the vehicle information of both cars in a chart format
Notes	

Test ID	10

Category	Evaluation of canceling orders
Requirements Coverage	UC17-Canceling an order
Initial Condition	The system has been initiated and runs. An order has been previously placed
Procedure	1. The user views their order history 2. The user selects the specific order 3. The order detail page is shown 4. The user submits a cancel order request
Expected Outcome	The user's order is canceled and the user receives a refund
Notes	The request should be submitted before the deadline (i.e. within 30 days or before order is shipped) Cancellation is offered for both unregistered and registered customers

Test ID	11
Category	Evaluation of writing reviews
Requirements Coverage	UC12-Writing reviews and rating vehicles
Initial Condition	The system has been initiated and runs. User has been confirmed as a verified purchaser.
Procedure	1. The user goes to their order history 2. The user selects the specific order 3. The order detail page is shown 4. The user selects the specific product to review through the "Leave a review" option 5. The review input box is displayed 6. The user writes their review and rates the vehicle out of 5 7. The user submits their review
Expected Outcome	The review is displayed in the reviews on the product's detail page along with the rating
Notes	Both unregistered and registered customers are allowed to leave a review as long as they are a verified buyer

Test ID	12
Category	Evaluation of administrator running a report
Requirements Coverage	UC18- Running a report
Initial Condition	The system has been initiated and runs

Procedure	1. The administrator logs in 2. The administrator selects "Run report" option 3. The administrator selects the specification option for their report 4. Report is displayed
Expected Outcome	Report for the desired information is displayed to administrator
Notes	

Test ID	13
Category	Evaluation of Vehicle listing in Catalog
Requirements Coverage	UC18- List Electric Vehicles in Catalog
Initial Condition	The system has been initiated and runs. User is currently in the catalog view.
Procedure	1. The user accesses the catalog view 2. A list of available cars is displayed
Expected Outcome	All available electric cars are displayed to the user, as per the "hot" by default or the latest filter according to the cookie.
Notes	According to filters, the list of available electric cars is shown

Test ID	14
Category	Evaluation of Vehicle Sorting in Catalog
Requirements Coverage	UC2- Sort Vehicles by prices or Mileage
Initial Condition	The system has been initiated and runs. User is currently in the catalog view.
Procedure	1. The user accesses the catalog view 2. A list of available cars is displayed 3. The user clicks on a button which holds the sorting options 4. The user selects their preferred filter with their options being: ascending prices, descending prices, low mileage, high mileage
Expected Outcome	The user should click on the button and have the correct options available, and by selecting the options change the sorting of the catalog as required by the filter.
Notes	The user can complete this action multiple times, with the sorting not carrying over between the sorting attempts.

	Also, a cookie should be created which saves the sorting preference

Test ID	15
Category	Evaluation of Full Detail View in Catalog
Requirements Coverage	UC4- View Full Details of Vehicles
Initial Condition	The system has been initiated and runs. User is currently in the catalog view.
Procedure	1. The user accesses the catalog view 2. A list of available cars is displayed 3. The user selects a car. 4. The car's full details can be seen additionally with a comment box above the cars icon 5. The user can close the box if they prefer.
Expected Outcome	On clicking the car, a comment box will appear above the car's icon, with the full details including it's history report being presented to the user.
Notes	The box should be closeable by clicking on the "x" button on the top right.

Test ID	16
Category	Evaluation of View Hot Deals in Catalog
Requirements Coverage	UC5- View Hot Deals in Catalog
Initial Condition	The system has been initiated and runs. User is currently in the catalog view.
Procedure	1. The user accesses the catalog view 2. A list of available cars is displayed 3. The user clicks on a button which holds the sorting options 4. The user selects to see hot deals in Catalog
Expected Outcome	The user can see the catalog view of cars sorted according to hot deals available.
Notes	This sorting should also be affected by other sorting features such as sort by ascending price or least mileage. It also should be the default view for a new user.