



TED UNIVERSITY

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CMPE 491 Analysis Report

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1.Introduction

Car Care+ is a mobile application designed to make life easier for car owners to manage their vehicle's health and maintenance in one place. It solves the problem of tracking different maintenance activities, reminders, and information required for vehicles that overwhelm vehicle owners. In this system, users will have an opportunity to track their mileage, tire pressure, and history of maintenance and receive timely notifications related to some major activities like tax, traffic ticket inquiry, oil change, and inspection.

Car Care+ primarily focuses on the development of an intuitive platform that will not only support users in maintaining their vehicles for a long period but will also contribute toward pleasurable driving with tools related to vehicle upkeep and convenience. The application will include a store for vehicle-related products, appointment scheduling, and API-based integrations that update the status of a vehicle.

2. Proposed system

Car Care+ is an integrated solution targeted at car owners, providing them with a single location to keep track of car maintenance performed, centralize key metrics about the vehicle, and alert them when basic car necessities are in need. This report does a deep dive into the proposed system by describing its functionality, requirements, and architecture in full detail.

2.1 Overview

Car Care is an all-in-one mobile application that allows every car owner to manage and protect the health of their vehicle. Decare is an all-in-one mobile application. By keeping the status of the vehicle under record, it provides assistance on issues such as vehicle maintenance, mileage tracking, vehicle maintenance history. Car Care+ provides users with timely reminders about pending tasks such as paying taxes, changing the oil and vehicle inspection. In addition, features such as directing vehicles to a special online store and to make a maintenance appointment are included in the application.

The system aims to facilitate the maintenance workflow, thus making it easier for car owners to reduce the chances of vehicle owners missing out on vital activities, increasing the life and safety of vehicles.

2.2 Functional Requirements

Vehicle status tracking:

CarCare+ will track the status of the critical components of a vehicle, including mileage, tire pressure, oil level, and the condition of the engine. All this information enables the user to understand the current status of his or her car and to take care of it in advance.

Appointment Scheduling System:

There will be a redirection section to the site where the appointment for vehicle inspection maintenance will be made. In this section, the user will access the appointment system link by clicking on the relevant field.

Notification and Reminders:

The app can send timely reminders to users regarding some important tasks, such as when to pay taxes, change the oil, and scheduled inspections. Notifications in the app are designed in such a way that users can be on top of essential requirements for their maintenance so that they never fail to do something serious.

Product Store:

Moreover, with CarCare+, there is a storage section where the user can view and purchase vehicle-related products. Variety in the store to facilitate the user in accessing the maintenance products they need right from the application.

2.3 Nonfunctional Requirements

Security:

Account Lockout Policy: This system will lock a user account for security reasons after 5 consecutive failed attempts with the wrong password. It will automatically get unlocked after 3 hours.

Password Policy: The password should not be less than 8 characters in length with a combination of uppercase, lowercase, numbers, and special characters.

Two-Factor Authentication: The users have the option of enabling two-factor authentication for their accounts, which can involve verification through Short Messaging Services or e-mail.

Performance:

Response Time for Critical Actions: In the case of a user accessing critical data with regards to the status of any vehicle, the maximum response time is 3 seconds. Notifications must reach the user with a maximum delay of 5 seconds.

Loading Time: The first screen will load in less than 10 seconds.

Refresh Frequency: Vehicle information will be refreshed every 30 minutes as long as the vehicle is running and the application is open.

Usability

First-Time Onboarding Completion Time: When the user logs onto the application for the very first time, he/she will undergo an onboarding process that can be completed in a maximum of 5 minutes to learn all the basic functions of the application.

Error Messages: In the case of a failure committed by the user, an appropriate error message will be displayed in an easily understandable manner with a proposed solution, such as "The password entered is wrong. Click here to reset your password."

Scalability

Database Scalability: The database backing the application will offer a horizontally scalable architecture as the number of users increases and will be optimized so that performance degradation does not exceed 5% for every additional 10,000 users.

Reliability

System Uptime: The application should guarantee at least 70% availability during the year, which means total downtime during a year should not exceed approximately 8 hours.

Backup Frequency: All user data should be backed up daily, hence in case of data loss, maximum data loss would occur for 24 hours.

Compliance

Data Retention Policy: The data of the users shall be kept only for a period of 30 days from

when the user terminates their account and then permanently deleted.

Transparency of Privacy Policy: The policy regarding the collection and processing of data by the Application shall be initially presented to the users for acceptance upon subscription to the Application, and any time the user wishes, this can be accessed from within the Application.

2.4 Pseudo Requirements

Platform Requirements

CarCare+ shall be developed as a mobile app, and Android should be supported at least from Android 8.0 onwards.

The application shall be built in compliance with the norms of the Android user interface design, based on the design and usage standards particular to this platform.

Environment and Development Tools

The back-end shall be implemented in Java with Spring Boot. These preferences are chosen in view of assuring a flexible and scalable structure for the system.

The Amazon RDS database will be used. This platform should be preferred because it provides database security, easy access, and backup opportunities while providing expandability.

The development processes will be followed in GitHub for the version control, and collaboration within the team shall be ensured.

System Availability

It shall have separate development and test environments from the production environment, such that possible updates or new features shall be integrated into the main system after they have been tested.

Compliance and Regulatory Requirements

The CarCare+ app shall be designed in observance of data privacy laws, like the GDPR. All information collected from users shall be processed once permission is duly asked for by the users and their privacy must be looked at in such a fashion.

Quality Assurance and Testing

Testing shall be carried out at all levels of the development: unit testing, integration testing, and system testing.

Compatibility testing also will be done in regard to ensuring the smooth working of the application's user interface for a range of device screen sizes and resolutions.

Documentation and Support

All the development processes and code structure of the project will be documented in detail for later use and as a reference for later developments.

User guides and help documents will be provided after the development to support the user on how to use the application.

2.5 System models

2.5.1 Scenarios

Scenario 1: The user needs to be reminded when it is time for an oil change

Scope: The CarCare+ application shall allow the user to indicate whenever the vehicle needs a critical oil change without the hassle of remembering when it could need an oil change.

Event Flow :

The user logs in to the CarCare+ application and updates his/her vehicle periodic mileage. The system processes the user input regarding the mileage entered.

It is determined that the user has completed a specific number of miles since the last oil change.

CarCare+ sends a notification to inform the user it is time to have an oil change. The user can click on the notification for more detailed information, showing the suggestions with authorized points of service around. The application shows the possibility of making a maintenance appointment, suggesting the best date and time.

Success Criteria: The application notifies the user on the due date of the oil change and the same settings can be done for setting up a maintenance appointment date.

Scenario 2: Sending a Reminder When Vehicle Tax Payment is Getting Closer

Scope: The user is informed about the dates of tax payments with the aim of decreasing the risk of forgetting their legal duties.

Event Flow:

When the user saves the vehicle information in the CarCare+ application, he includes the vehicle tax date in the system.

The system performs periodic verification of the registered tax payment date.

With 15 days remaining from the date of tax payment, CarCare+ notifies the user. The user will see, through notification, the date of tax payment and details about the process. The application redirects the user to the official website where the payment is to be made.

Success Criteria: The user gets reminded before missing the tax payment date, with ease of making the said payment.

Scenario 3: Placing an Order for Car Care Products through the Store

Scope: The user buys products through the application to maintain their vehicle with ease.

Event Flow:

The user enters the "Store" section in the application CarCare+ and starts browsing through the maintenance products for the vehicle, like filters.

User chooses the product "Air Filter" and goes on to check the details of the product. He adds the product to the cart and advances to the steps for making the payment.

In the end, the client pays for what he ordered by inserting credit card information in a secure way.

Success criteria: The customer finds maintenance products suitable for his vehicle and is able to place the order with ease. Payment goes through in security.

Scenario 4: Redirect for Maintenance Appointment

Scope: The user will reach the correct service website for a maintenance appointment using the CarCare+ app.

Event Flow:

First, the user opens the CarCare+ app, goes to the bottom bar on the home screen, and clicks the "Make an Appointment" tab.

User clicks on "Make an Appointment."

The system will redirect him to the appointment page of the service provider.

The user selects date, time, and appointment point for an appointment on the service provider website.

After setting the appointment, CarCare+ gives the option of adding a reminder to the user.

Success Criteria: The user is routed to the right service provider based on the needed maintenance and he or she is able to navigate the process in terms of booking an appointment.

Scenarios 5: Traffic Ticket Inquiry

Scope: To query a traffic ticket via the application, the user clicks on the section and is directed to the necessary website (e-government, etc.) to perform the query.

Event Flow:

Enter the CarCare+ application and click on the traffic ticket inquiry section to be directed to the relevant website.

The application directly redirects the user to the E-Government or official website for traffic fine queries.

The user searches for a fine by logging into the official website with their identity information or license plate information.

Any traffic fines that a person may have are then listed on the screen from the result of the inquiry. It allows one to proceed with the steps of paying the fine via the relevant site.

Success Criteria: The user can easily query the traffic fine information and learn about the steps to pay it.

Scenario 6: Insurance Renewal Reminder

Scope: CarCare+ reminds the user in advance when the date of vehicle insurance renewal is near.

Event Flow:

The user stores details about his vehicle insurance in CarCare+.

The system keeps track of the date for insurance renewal and notifies the user a month in advance of the renewal date.

Success Criteria: The user is reminded before he misses his insurance renewal date.

Scenario 7: Periodic Inspection Date Reminder

Scope: The user gets a reminder on the CarCare+ for periodic inspection dates so that the user does not miss a periodic inspection date of the vehicle.

Event Flow:

The user records the date of vehicle inspection through the CarCare+ app.

The system generates an outgoing reminder notification of an upcoming inspection 1 month in advance of the actual date of the inspection.

By tapping the notification, especially the "Get Inspection" button, a user will be routed to the official page where inspection services are offered.

Here, the user selects the date and time that would be easy for him for the visit of the inspection.

Success Criteria: The user finds out in time the periodic date of inspection and manages to get the process completed by making an appointment.

2.5.2 Use Case Model

The use case diagram explains how the user will interact with the system and the main functionality of the CarCare+ application.

1. Use Case 1: Monitoring Vehicle Status

- **Actor:** User
- **Description:** The user opens the application to check the conditions of their vehicle. On the main page, they will see information like tire pressure, mileage, fuel level, and battery status conditions.
- **Preconditions:** The user must be logged in. Customer must have provided their vehicle information.
- **Postconditions:** The user successfully viewed their vehicle status information.
- **Normal Flow:** The user navigates to the " Vehicle Status" page and views their current information.

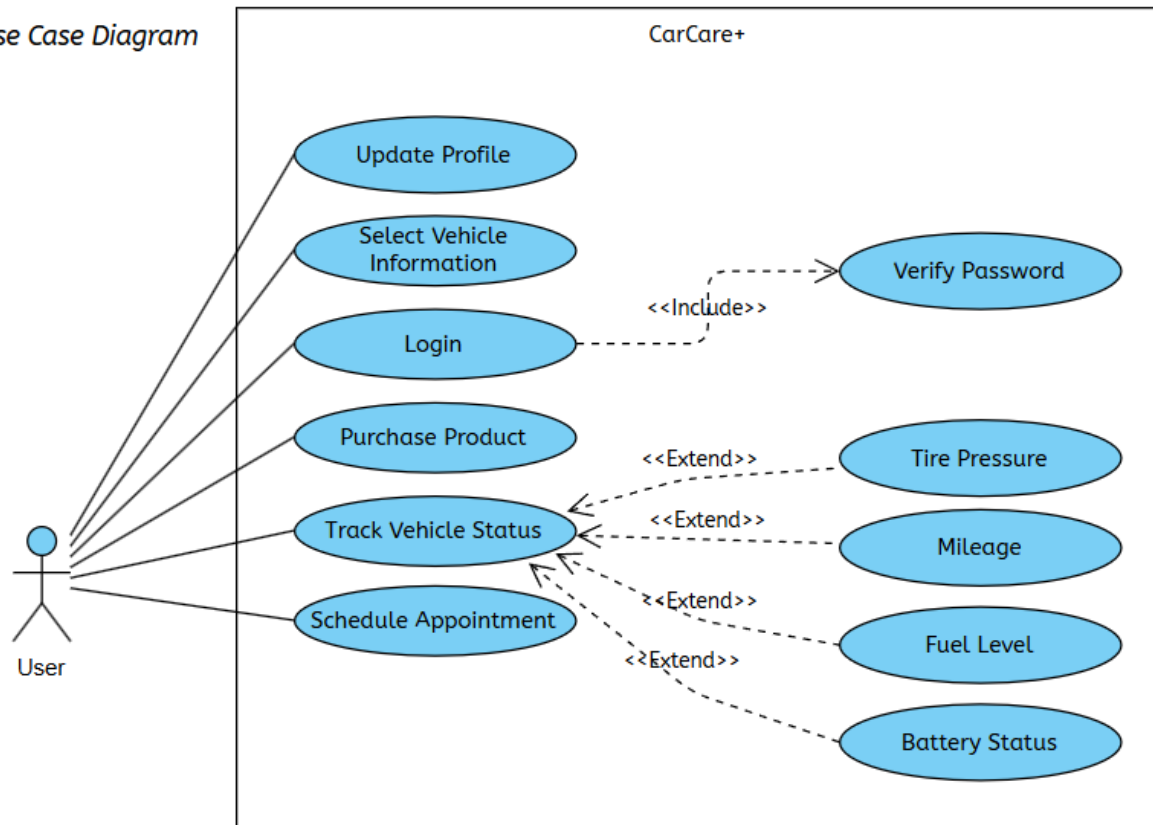
2. Use Case 2: Scheduling a Maintenance Appointment

- **Actor:** User
- **Description:** The user opens the appointments section to schedule an appointment for a suitable date. Applications show them the available dates and hours.
- **Preconditions:** The user must be logged in and their maintenance history should be on the system.
- **Postconditions:** The user scheduled a maintenance appointment and got approval from the system.
- **Normal Flow:** The user navigates to the “Appointments” section and schedules a maintenance appointment on an available date.

3. Use Case 3: Purchasing Products From the Store

- **Actor:** User
- **Description:** The user wants to purchase a required product for their vehicle. They can purchase the products they desire in the shop section of the application.
- **Preconditions:** The user must be logged in and have a valid payment method.
- **Postconditions:** The user purchased the product successfully and received order information.
- **Normal Flow:** The user navigates to the “Shop” section, adds the desired products to their card, and completes the payment process.

Use Case Diagram



2.5.3 Object and Class Model

In this part we will look at our five main classes; their features, their relations with other classes, and some of their methods. This will help on better understanding how the CarCare+ will work and how all the systems interact with each other.

1. User Class

- **Features:** UserID, Name, Surname, E-mail, Password, SubscriptionDate, AmountOfCars, PaymentMethod.
- **Relations:** User-Vehicle (Users can add **1 or more** cars to the app.), User-Product (Users can add **more than one** product to their basket), User-Market(All users have the same store).
- **Methods:** Sign In, ChangePassword, UpdateProfile, UpdatePaymentMethod.
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2. Vehicle Class

- **Features:** VehicleID, Model, Brand, Milage, TirePressure, OilLevels, FuelLevel, BatteryStatus.
- **Relations:** Vehicle - User (Each vehicle can only belong to **one** user). Vehicle – Product (A vehicle may have **more than one** fitting product in the market).
- **Methods:** UpdateInformation, UpdateStatus, ShowMaintenanceHistory.

3. Product Class

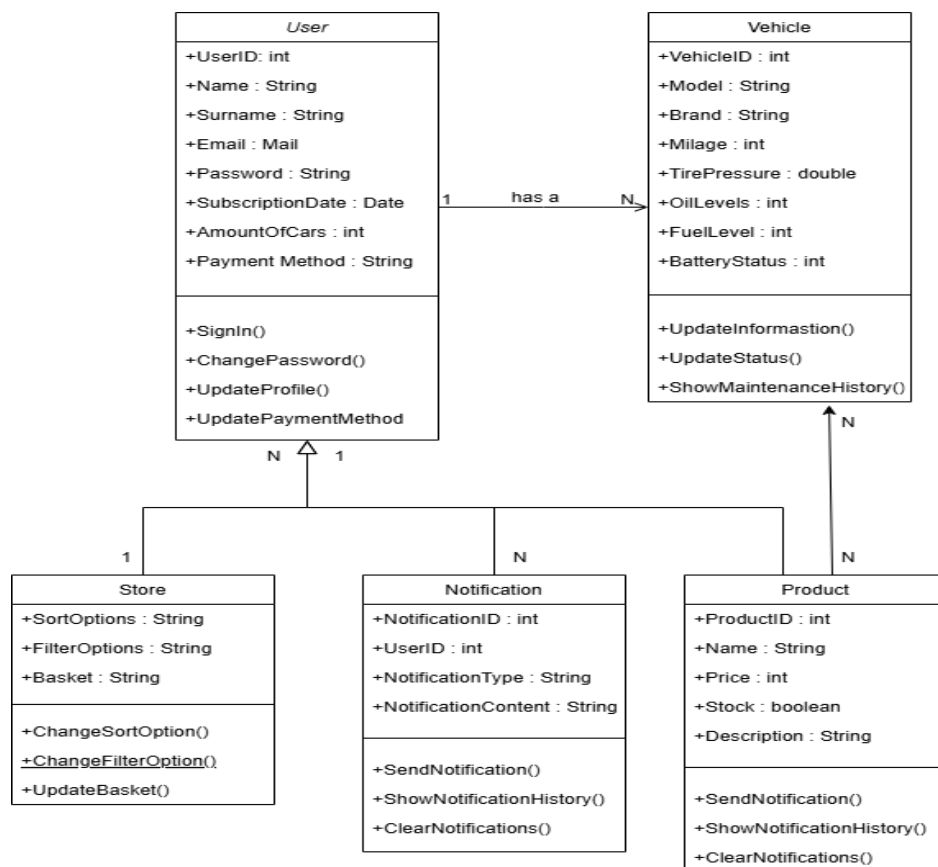
- **Features:** ProductID, Name, Price, Stock, Description.
- **Relations:** Product - Store (**All** products must be on the store page), Product – User (If there is enough stock all users can buy the same product).
- **Methods:** UpdateInformation(stock,name,price), ShowDescription, UpdateDescription.

4. Store Class

- **Features:** SortOptions, FilterOptions, Basket.
- **Relations:** Store - Product (Store can have **multiple** products).
- **Methods:** ChangeSortOption, ChangeFilterOption, UpdateBasket.

5. Notification Class

- **Features:** NotificationID, UserID, NotificationType, NotificationContent.
- **Relations:** Notification - User (Each notification belongs to one user).
- **Methods:** SendNotification, ShowNotificationHistory, ClearNotifications.



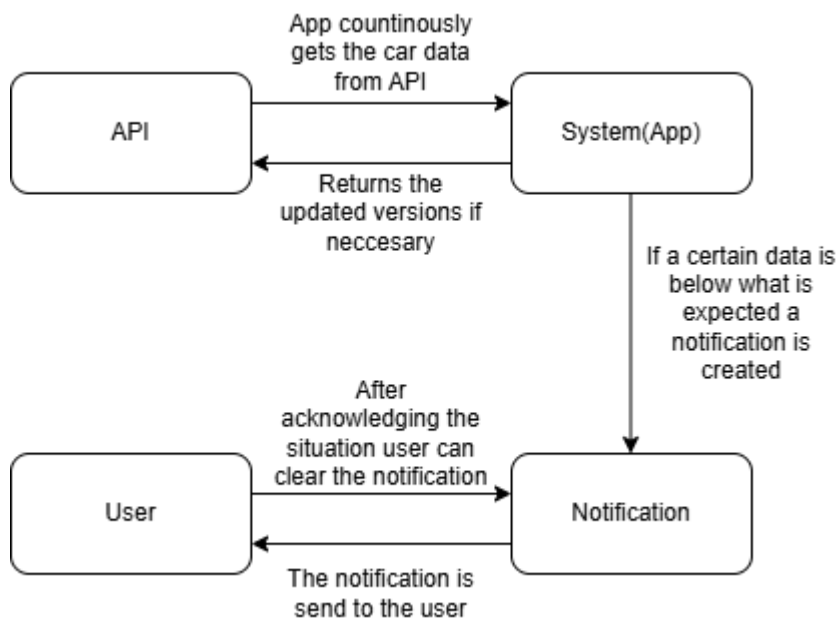
2.5.4

Dynamic Models

Dynamic models show the behavior of the system over time and interactions between objects.

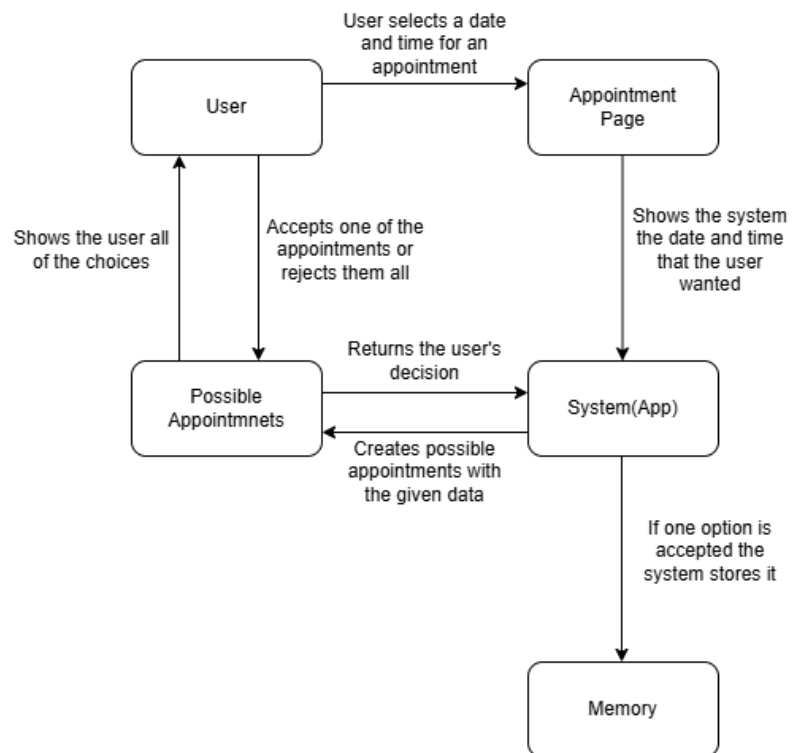
1. Notification Process

- **Scenario:** The application checks vehicle information from API regularly. Parameters like tire pressure or fuel level are below the normal limit, a notification is sent to the user.
- **Process Flow:**
 - System retrieves vehicle data from the API.
 - If a parameter is below the limit, a notification is created.
 - Notification is sent to the user.

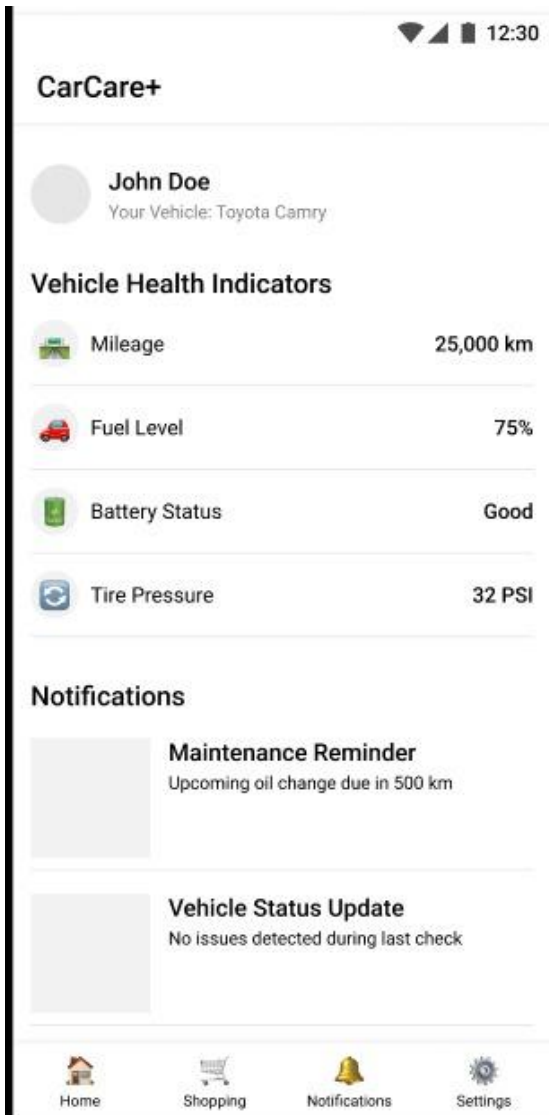


2. Appointment Process

- **Scenario:** User searches for an appointment. The system shows the available dates and hours. The user selects a suitable date and the system approves it.
- **Process Flow:**
 - User navigates to the appointments section and searches for an appointment.
 - System shows the available dates and hours.
 - The user selects a date and the system approves it.



2.5.5 User Interface



Dashboard

The Purpose of The Page

To provide users with an overview of the current health status of their vehicle, including mileage, fuel level, battery condition and tire pressure. This page also includes important maintenance reminders and vehicle updates.

User Experience

Users can easily monitor the critical health indicators of their vehicles at a glance.

Maintenance reminders and notifications inform users about upcoming service needs.

A user-friendly layout allows users to understand the condition of their vehicles without technical expertise.

Features

Vehicle Information: The user's name and vehicle details (e.g. Brand and model) images.

Health Indicators: Includes measurements such as mileage, fuel level, battery status and tire pressure.

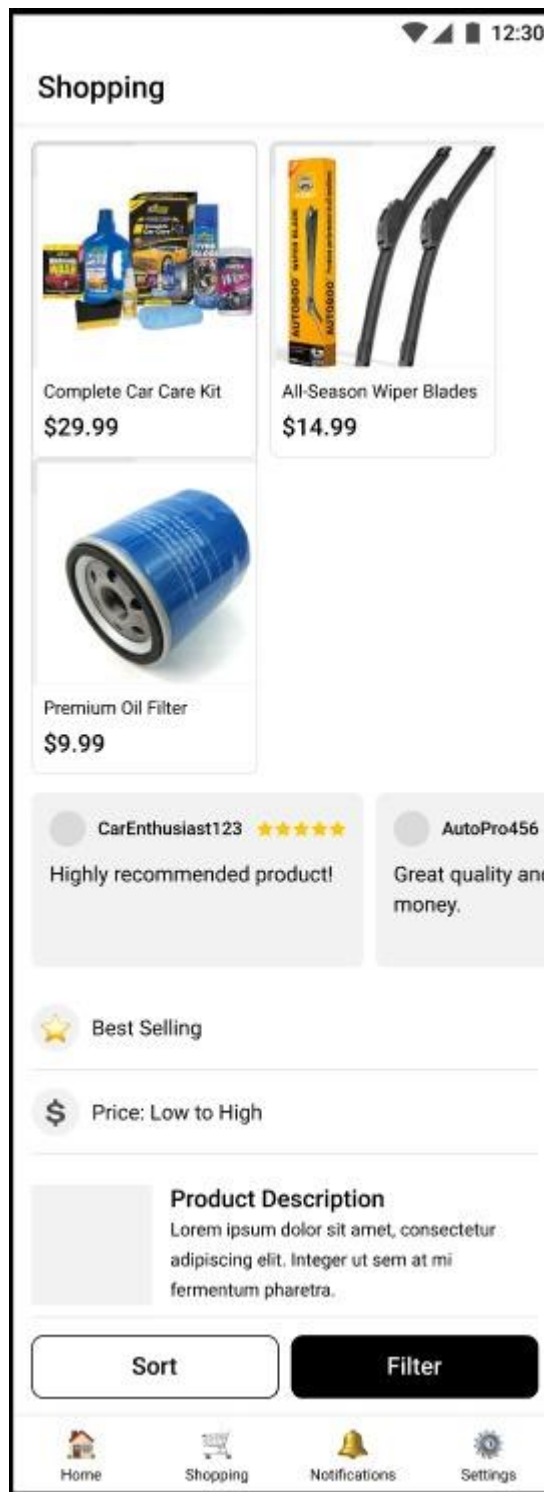
Notifications Section: This provides reminders for scheduled maintenance and status of vehicles.

Clipboard Layout: Organizes data clearly for quick understanding.

Usage Scenario

Users come to this page for an overview of their car's health and to prepare for routine maintenance.

Notifications help users stay proactive in servicing their vehicle, avoiding problems.



Shopping Page

The Purpose of The Page

To provide users with an online shopping platform for products their vehicles may need, such as maintenance kits, wipers, and oil filters. The page will show details of the products, their prices, and reviews from users.

User Experience

Users can quickly locate the products they need and view all the information.

Product sorting and filtering options improve the shopping experience.

Features

Product List: Product name, image, price and user reviews

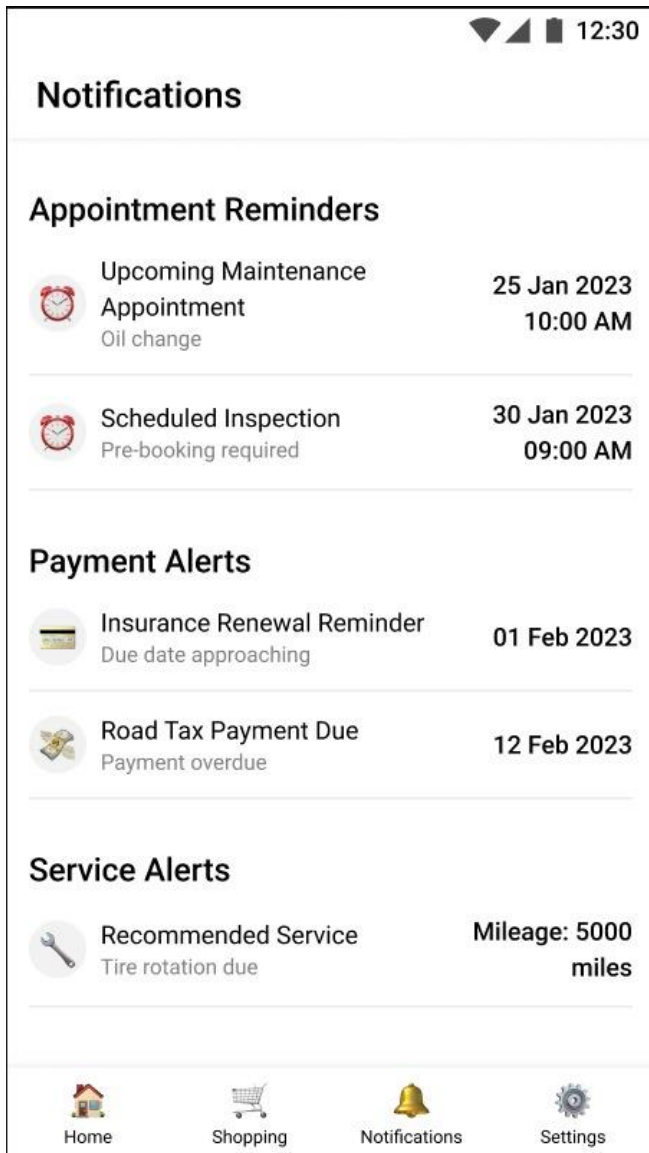
Sorting/Filtering Options: "Best Sellers" or "Sort by Price"

Product Description: Informs the user to make a better decision

Usage Scenario

Users find the products suitable for their vehicles and make a purchase decision

Filtering/Sorting features help them to reach the product they are looking for in a short time



Notifications

The Purpose of The Page

To inform users about critical updates related to their vehicles, including, but not limited to, maintenance appointments, pay dates and service alerts.

User Experience

The user is informed of all critical updates from one place and allows him to stay on top of his responsibilities related to the vehicle.

Notifications organized under categories make it easy to track which actions are required.

Appointment details and pay alerts help users plan ahead.

Features

Appointment Reminders: Lists upcoming care appointments with date, time and description.

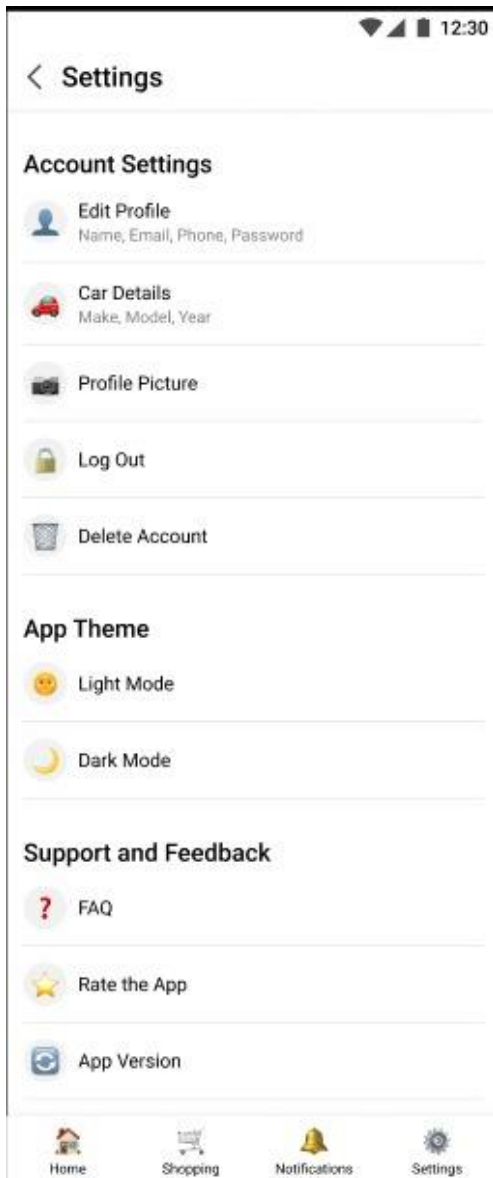
Pay Alerts: Shows upcoming or overdue payments, such as insurance renewals and taxes.

Service Alerts: Displays all recommended services, including tire turns and oil changes, with relevant mileage data.

Categorized Notifications: A reminder, pay alerts, and service alerts are grouped together for easier use.

Usage Scenario

This page is visited quite often by users who are trying not to miss maintenance appointments, pay deadlines or critical service needs. The format will make it much easier to help them quickly evaluate and handle urgent updates



Settings Page

The Purpose of The Page

The settings page is for users to manage their accounts, customize their app preferences, and access support seamlessly.

User Experience

It will be able to go through account-related options, app theme settings, and feedback/support tools without too much hassle. By organizing items in a regular and practical way, the page guides the user to smoothly handle their preferences and troubleshoot problems when necessary.

Features

Account Settings

Edit Profile: Users can update their name, email, phone and password information.

Vehicle Details: Users can add new or update the existing details of their vehicle (model, brand, year).

Profile Picture: Users can change or upload their profile picture.

Log Out: This feature securely signs the user in.

Delete Account: The user's data is permanently deleted along with their account.

Application Theme

Light mode: Switches the application to light color mode.

Dark Mode: Turns on the dark mode for the app to get closer to the eye more easily.

Support and Feedback

FAQ: Answers to frequently asked questions.

Rate the App: Asks the user to give feedback and rate the app.

Application Version: Tells you which structure the application is currently sitting in.

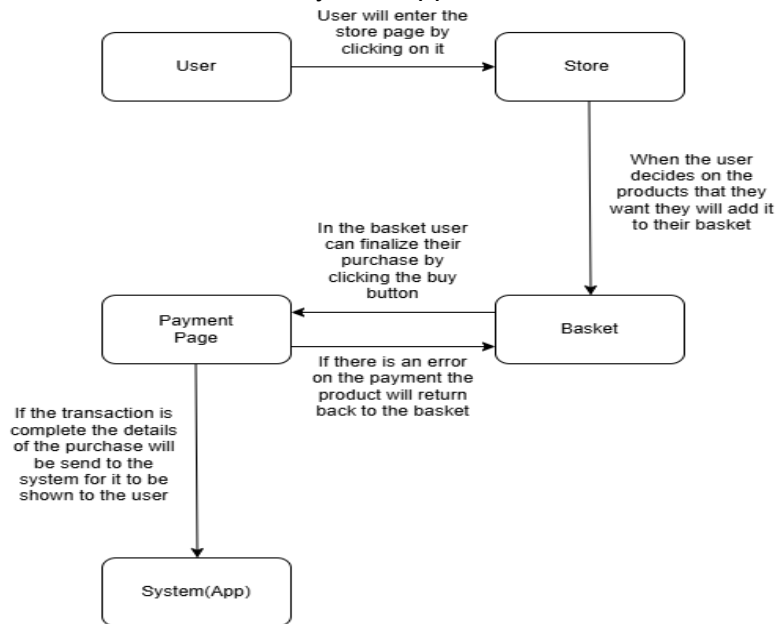
Usage Scenario

This page is necessary for users who want to personalize their app experience, manage their profile or vehicle information, or get support. Whether it's changing a theme for better usability or using an account management tool, this is a frequently visited page for convenience and customization.

3. Purchase Process

- **Scenario:** The user navigates to the store section to choose a product, adds it to the basket, and completes the payment.
- **Process Flow:**
 - User navigates to the store section to choose a product
 - Adds it to the basket and goes to the payment section.
 - User completes the payment.

- System approves and sends order details to the user.



3. Glossary

API: Application Programming Interface - An interface that controls information exchange between CarCare+ and the external world, such as services that deliver information about cars. Due to APIs, an application is able to retrieve current data and provide new information to its users.

Authentication: The process allowing verification to occur for users to access the application. It means CarCare+ tries to ascertain who the user actually is through password protection or two-factor authentication.

Data Encryption: This refers to encrypting data with the intent of ensuring that the data of users is kept safe and out of the reach of unauthorized persons. CarCare+ applies methods of data encryption to protect user data.

GDPR (General Data Protection Regulation): It is the European Union-enforced regulation on ensuring data privacy. CarCare+ is obliged to ensure compliance with GDPR in processing and storing users' personal data.

Security Compliance: It is developed with security and data privacy standards in mind. CarCare+ enforces all the necessary securities to keep it regulated, like GDPR.

User Interface: These are the various screens and design elements through which a user interacts with an application. CarCare+ uses an intuitive interface to view your vehicle's health status and manage maintenance operations.

Vehicle Status: The current health and maintenance status of your vehicle. Certain key information provided by the CarCare+ application is available to the user concerning your vehicle, such as the current mileage of the vehicle, engine oil level, and tire pressure.

Two-Factor Authentication: This adds another form of verification apart from the password for added security for the users. In CarCare+, two-factor authentication options are available to users for preference.

Onboarding: Guides or directions that help a new user learn basic ways of working with an application. CarCare+ has designed a process for onboarding to introduce the interface to the first-time users of the app.

High Availability: It is the condition when the application is readily accessible to its users at all times. Through cloud services, CarCare+ is trying to achieve 99.9% availability on a yearly basis.

Data Retention: A set of regulations that determine how user data will be retained in our system. User data in CarCare+ will be kept for a maximum of 30 days after account closure and then deleted permanently.

4. References

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