# Stage 1: Project Proposal
# CS 411 Team080-yoyo

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## I. Project Title

*Used Car Market Analysis and Recommendation System*

## II. Project Summary

The Used Car Market Analysis and Recommendation System is a web application designed to help users navigate the used car market efficiently. The application provides advanced filtering and live search capabilities, price trend analysis, and a hybrid recommendation system. It aims to solve the problem of information overload and decision paralysis by offering personalized recommendations and insightful market trends. The system also includes user management features, allowing buyers and sellers to interact seamlessly.

## III. Description

The application allows users to search for used cars based on various criteria such as brand, price, year, mileage, and fuel type.The advanced filtering and live search feature dynamically updates results as users adjust their search parameters, enhancing the user experience. Additionally, the system provides historical price trends for specific car models, helping users understand market fluctuations and make informed decisions. An optional price prediction model using linear regression can forecast future price change.

The hybrid recommendation system personalizes the shopping experience by suggesting cars based on recent views, user favorites, and overall platform popularity. This reduces search time and encourages further exploration, potentially boosting sales. The application also includes user management functionalities, enabling secure registration, profile management, and role-based access for buyers, sellers, and administrators.

Overall, the Used Car Market Analysis and Recommendation System aims to streamline the car-buying process, providing users with a comprehensive tool to make informed decisions while offering sellers a platform to manage listings effectively.

## IV. Technically challenging features

### A. Advanced Filtering & Live Search

a. Multi-condition filtering (brand, price, year, mileage, fuel type, etc.), with instant updates as conditions change (no need to press "search").
b. Backend dynamically queries the database based on user-selected filters and returns matching results in real-time.
c. Enhances user experience with smooth, responsive filtering.

### B. Price Trend Analysis & Prediction

a. Display historical price trends when users search for specific car models, helping them understand price fluctuations.
b. Optionally include a simple price prediction model (e.g., linear regression) to forecast future price changes.

### C. Hybrid Recommendation System

a. **Recent Views Recommendation**: Based on LocalStorage or backend records, recommend cars of the same brand or similar price range → Helps users quickly revisit cars, reducing search time.
b. **Favorites-Based Recommendation**: Based on user favorites, suggest other cars from the same brand or similar models → Encourages further exploration and boosts sales.
c. **Popular Cars Recommendation**: Based on platform-wide view and favorite counts, suggest the most popular cars → Builds user trust and highlights trending options.
d. Personalizes the shopping experience, increasing user engagement and conversion rates.

## V. Usefulness

The used car market is often overwhelming for buyers due to information overload, unreliable pricing, and lack of personalized recommendations. Sellers, on the other hand, struggle to reach potential buyers efficiently and price their vehicles competitively. Our application addresses these challenges by offering a data-driven, user-friendly platform with advanced filtering, personalized recommendations, and real-time market insights.

### A. Basic Functions:

a. Search & Filter Used Cars: Users can search by brand, model, price, year, mileage, fuel type, transmission, and location.
b. Dynamic Sorting & Filtering: Results update instantly as users adjust filters, without reloading the page.
c. User Profiles & Authentication: Buyers and sellers can create accounts, manage preferences, and interact within the platform.
d. Seller Listings & Management: Sellers can post, edit, and manage vehicle listings easily.
e. Buyer-Seller Interaction: Secure messaging/contact options allow potential buyers to communicate with sellers.

### B. Advanced Features:

a. Live Search & Advanced Filtering: A real-time search feature instantly updates listings as users refine their criteria, enhancing user experience.
b. Price Trend Analysis & Prediction: Buyers can view historical price trends of specific models and forecast future price fluctuations using machine learning.
c. Hybrid Recommendation System:

i. Recent Views-Based Suggestions: Recommend cars similar to those recently viewed.
ii. Favorites-Based Suggestions: Suggest cars based on the user's saved listings.
iii. Trending Cars: Highlight the most viewed and favorited cars on the platform.

d. Saved Searches & Alerts: Users can save search criteria and receive notifications when matching cars are listed.
e. Market Insights & Statistical Visualizations: Graphs and reports help users analyze price trends and market fluctuations.

**C. Comparison with Similar Applications:**

a. CarGurus: Provides price analysis but lacks personalized recommendations.
b. AutoTrader: Focuses on listings but does not offer live filtering or trend predictions.
c. Kelley Blue Book (KBB): Offers pricing tools but lacks interactive user features.
d. TrueCar: Provides price comparisons but does not personalize recommendations.

**D. How is our application different?**

**a.** Real-Time Filtering & Live Search – Unlike static search platforms, our app instantly updates results based on changing filters.
**b.** Hybrid Recommendation Engine – A personalized system that adapts to user behavior.
**c.** Statistical Market Insights – Price trend analysis and predictive analytics help users make data-driven decisions.

## VI. Realness

### UK Used Car Market Dataset

**A. Source:** The dataset is obtained from Kaggle, is provided by Guanhao Peng: https://www.kaggle.com/datasets/guanhaopeng/uk-used-car-market?resource=download

**B. Format:** The dataset is available in CSV format, which is a common format for tabular data.

**C. Data Size:**

**a. Cardinality:** The dataset contains 66,663 rows, each representing a used car listing.
**b. Degree:** The dataset has 9 columns, meaning each row has 9 attributes.

**D. Information Captured:**

**a. Make:** The manufacturer of the car. (e.g., Ford, Toyota..)
b. **Model:** The specific model of the car (e.g., Focus, Corolla..)
c. **Year:** The year the car was manufactured.
d. **Mileage:** The number of miles the car has been driven.
e. **Price:** The price of the car in GBP.
f. **Fuel Type:** The type of fuel the car uses. (e.g., Petrol, Diesel)
g. **Transmission:** The type of transmission. (e.g., Manual, Automatic)
h. **Engine Size:** The size of the car's engine in liters.
i. **MPG:** The miles per gallon (fuel efficiency) of the car.

## VII. Functionality

Our application provides a comprehensive user experience for both buyers and sellers, integrating search, recommendations, and market insights. Below is a breakdown of core functionalities.

**A. User Management**

a. **Create**: Users can register via email and set up their profiles.
b. **Read**: View their profile information, saved searches, and past activity.
c. **Update**: Modify account details, including contact preferences and saved searches.
d. **Delete**: Deactivate or delete an account permanently.
e. Roles & Access:
    i. Buyers: Search for cars, save listings, view recommendations, and contact sellers.
    ii. Sellers: List vehicles for sale, manage listings, and track views/favorites.
    iii. Admins: Moderate listings, approve sellers, and handle disputes.

**B. Search & Filtering**

a. **Create**: Save searches and set up alerts for new matching listings.
b. **Read**: View available cars based on dynamic filters and sorting.
c. **Update**: Adjust search criteria and filters in real time.
d. **Delete**: Remove saved searches or alerts.
e. Advanced Filtering Features:
    i. Multi-condition filtering (brand, price, year, mileage, fuel type, transmission, location).
    ii. Instant result updates without needing to press "search".
    iii. Sorting by price, mileage, year, and popularity.

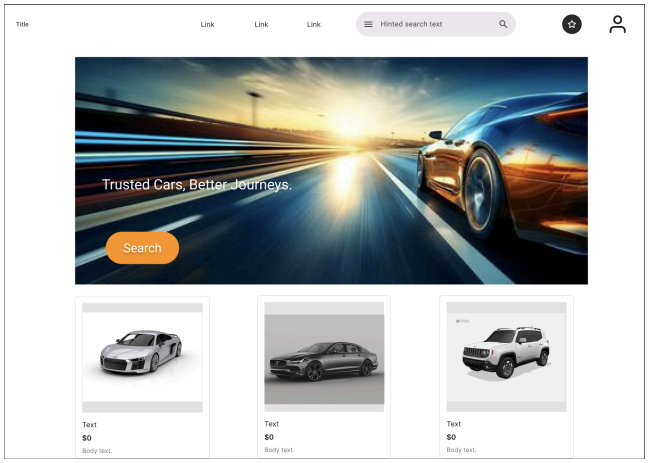
**C. Car Listings & Management (For Sellers)**

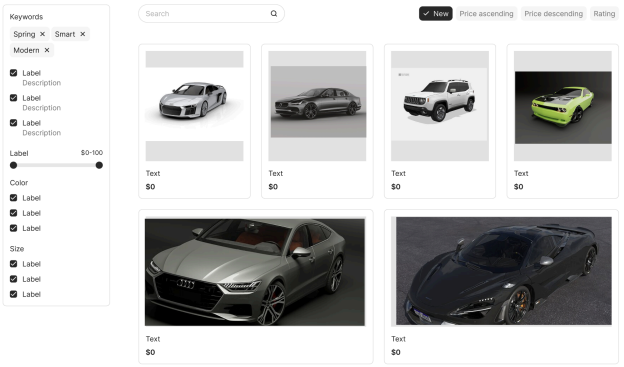
a. **Create**: Post new car listings with images, descriptions, and pricing.
b. **Read**: View their current and past listings.
c. **Update**: Edit car details such as price, photos, and description.
d. **Delete**: Remove listings once the car is sold.

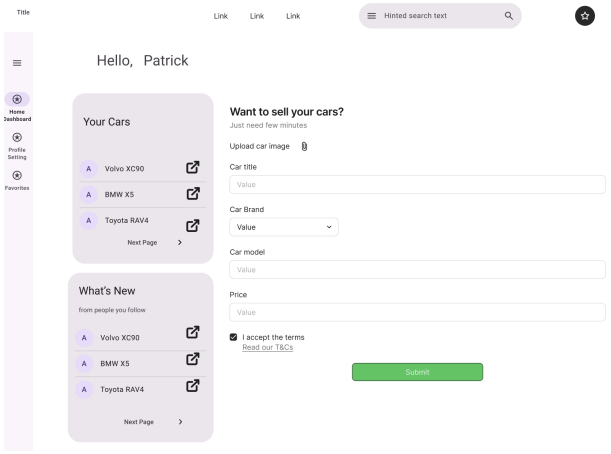
**D. Statistical Visualization & Market Trends**

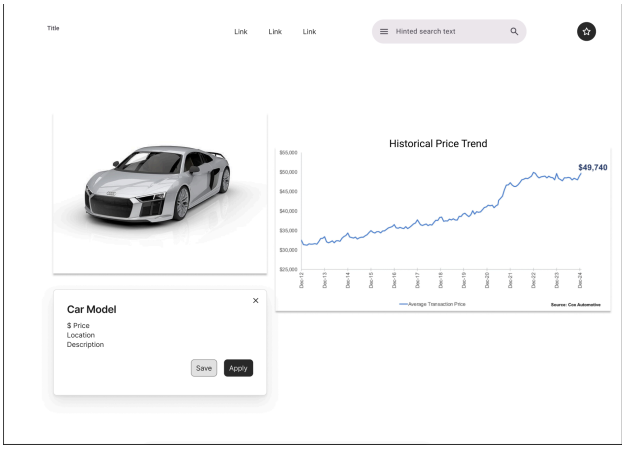
a. **Create**: Generate personalized reports based on user preferences.
b. **Read**: View interactive price trend graphs for different car models.
c. **Update**: Adjust analysis parameters (e.g., compare different car brands over time).
d. **Delete**: Remove outdated insights or historical data if necessary.
e. Visualization Features:
    i. Price Trends Over Time: Line charts displaying historical price fluctuations.
    ii. Recommendation-Based Reports: Help users make informed decisions based on market trends.

**A low-fidelity UI mockup**






## Project work distribution

| Module | Key Tasks | Assigned Member |
|---|---|---|
| Database Design | - Design ER Diagram and database schema.<br>- Create tables (Users, Cars, Favorites).<br>- Set up keys, constraints, indexes. | Guan Hong Lin |
| Authentication & User Management | - Implement user registration & login.<br>- Set up JWT authentication & password hashing.<br>- Manage roles & profiles. | Chia-Yu, Wang |
| Cars Listing & Management | - Develop CRUD APIs for cars.<br>- Implement search, filtering, and favorites. | Li, Chengzhe |

| | | |
|---|---|---|
| | - Validate inputs. | |
| API Documentation, Testing & DevOps | - Write API documentation (Swagger/Postman).<br><br>- Set up unit & integration tests.<br><br>- Manage local setup & version control. | Nicole Chen |