**Project Synopsis:**

**Used Car Price Prediction**

**1. Objective:**  
The primary goal of this project is to build a predictive model that accurately estimates the resale value of used cars based on various features such as age, mileage, fuel type, owner type, and other attributes. By leveraging machine learning algorithms, the project aims to provide insights into the factors influencing car prices and help stakeholders make informed decisions.

**2. Motivation:**  
The used car market has witnessed rapid growth, making it crucial to understand the dynamics of car resale values. Sellers and buyers often face challenges in determining fair prices due to the numerous variables involved. This project provides a data-driven approach to address this issue, ensuring transparency and efficiency in price estimation.

**3. Dataset:**  
The dataset includes information about used cars, including features like:

* **Numerical:** Age, Price ,ETC.
* **Categorical:** Fuel Type, Body Style, Company, Model, and Owner Type.

**4. Techniques Used:**

* **Data Preprocessing:** Handling missing values, outlier detection and removal, and data transformation.
* **Feature Encoding:** Label encoding and target encoding for categorical features.
* **Exploratory Data Analysis (EDA):** Visualizing relationships between features and identifying key factors affecting price.
* **Model Development:** Decision Tree and Random Forest Regressors were trained, evaluated, and optimized.
* **Evaluation Metrics:** R² Score, Mean Squared Error (MSE), and Mean Absolute Error (MAE) were used to evaluate model performance.

**5. Key Results:**

* Random Forest Regressor performed better than Decision Tree Regressor
* The Random Forest model outperforms the Decision Tree model in all metrics:

Lower MSE: Smaller squared errors overall.

Lower MAE: Smaller average error.

Higher R²: Explains more variance (87.8%).

* Insights such as the impact of car age, odometer reading, and fuel type on resale value were obtained.

**6. Applications:**

* Assisting used car dealers and buyers in price negotiations.
* Providing insights into factors influencing the resale value of cars.
* Enabling fair and transparent pricing in the used car market.

**7.Conclusion**

From the analysis, I found two major insights about the used car market: **demand** and **price**. Lower-priced cars are in higher demand compared to expensive ones, showing that customers prefer budget-friendly cars. However, some interesting patterns emerged during the study:

1. **Car Companies**:  
   Luxury brands like MG, Mercedes Benz, BMW, Volvo, and KIA have the highest prices. On the other hand, brands like Maruti Suzuki, Hyundai, Honda, Mahindra, and Tata are in higher demand. This suggests customers prefer buying new luxury cars but opt for budget-friendly brands in the used car market.
2. **Fuel Types**:  
   Most cars run on petrol or diesel, with diesel cars generally priced higher.
3. **Car Colors**:  
   Common colors like white, grey, silver, and black are in high demand. Exotic colors (e.g., burgundy, dark blue) tend to have higher prices.
4. **Odometer Reading**:  
   Cars with lower mileage (less than 10,000 km) have higher resale prices.
5. **Body Styles**:  
   Hatchbacks, SUVs, and Sedans are the most popular among buyers. However, MPVs, SUVs, and Sedans are the most expensive.
6. **Car Age**:  
   As cars get older, their resale value drops. Cars under 5 years old are preferred and have higher prices.
7. **Location and Dealers**:  
   States like Delhi, Maharashtra, and Rajasthan have the highest car prices. Dealers like Car Estate, Star Auto India, and Car Choice top the list for selling high-priced cars.
8. **Ownership Type**:  
   First-owner cars are in the highest demand and have the highest prices. Cars with warranties are also priced slightly higher.
9. **Quality Score**:  
   Cars with better quality scores fetch higher prices.

**Machine Learning Insights**:  
I used Decision Tree Regressor and Random Forest Regressor to predict car prices. The Random Forest model outperformed the Decision Tree. The most important features influencing price were Model,car age, body style, and company.