🚙 Used Car Price Prediction System 🚙

“ Car Valuation Tool ”

Submitted by –

NAME: Jubin Mazumdar

REGISTRATION NUMBER: 12316322

ROLL NUMBER: 43

SECTION: 9P172

1. Title of the Project

Used Car Price Prediction using Machine Learning

2. Objective

The objective of this project is to develop a machine learning-based system that predicts the selling price of used cars based on various features such as brand, fuel type, vehicle age, kilometers driven, engine capacity, and more.

The system helps users:

- Estimate the market value of their car
- Make better buying/selling decisions
- Get instant predictions via a web interface

3. Problem Statement

In the used car market, determining the correct price is challenging due to multiple influencing factors. Sellers often overprice or underprice their vehicles due to lack of knowledge.

This project aims to solve this problem by:

- Analyzing historical car data
- Using machine learning to predict accurate prices

4. Dataset Description

- Dataset used: CarDekho Dataset

  https://www.kaggle.com/datasets/manishkr1754/cardekho-used-car-data
- Contains features such as:
  - Brand
  - Fuel Type
  - Transmission Type
  - Seller Type
  - Vehicle Age
  - Kilometers Driven
  - Mileage

- Engine (CC)
- Max Power (bhp)
- Number of Seats
- Selling Price (target variable)

- Preprocessing steps:
  - Removed unnecessary columns (car_name, Unnamed: 0)

- train_model
  - Applied log transformation on target variable to normalize skewed data
  - Handled categorical and numerical features separately

5. Technologies Used

- Python
- Pandas & NumPy → Data processing
- Scikit-learn → Model building
- Streamlit → Web application
- Pickle → Model saving/loading

6. Machine Learning Approach

- Feature Engineering
  - Categorical features encoded using OneHotEncoder
  - Numerical features used directly

- Model Used
  - Random Forest Regressor

  Reason:
  - Handles non-linear relationships
  - Works well with mixed data types
  - Reduces overfitting using multiple trees

- Training Process
  - Data split into:
    - 80% Training
    - 20% Testing
  - Model parameters:
    - n_estimators = 100
    - max_depth = 15

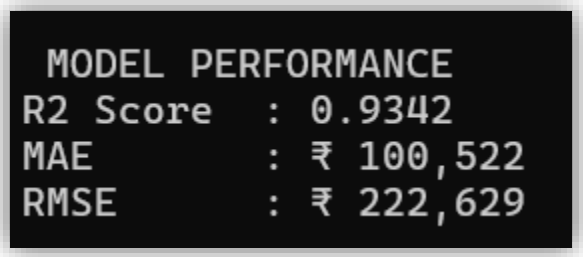
7. Model Evaluation Metrics

The model is evaluated using:

- R^2 Score → Accuracy of prediction
- MAE (Mean Absolute Error) → Average prediction error
- RMSE (Root Mean Squared Error) → Penalizes large errors

These metrics ensure the model performs well on unseen data.

- Model Results:



- Interpretation:
  - The R^2 score of 0.93 indicates that the model explains 93.42% of the variance, which means high accuracy.
  - The MAE (~₹1 lakh) shows the average prediction error is reasonable for car prices.
  - The RMSE (~₹2.2 lakh) indicates some larger errors but still acceptable for real-world data.

8. System Architecture

- Training Phase
    1. Load dataset
    2. Preprocess data
    3. Encode categorical features
    4. Train Random Forest model
    5. Save:
        - model.pkl
        - encoder.pkl
        - columns.pkl

- Prediction Phase
    1. User inputs data via UI
    2. Data is encoded
    3. Model predicts log price
    4. Converted back using exponential
    5. Display final price

9. Web Application (Frontend)

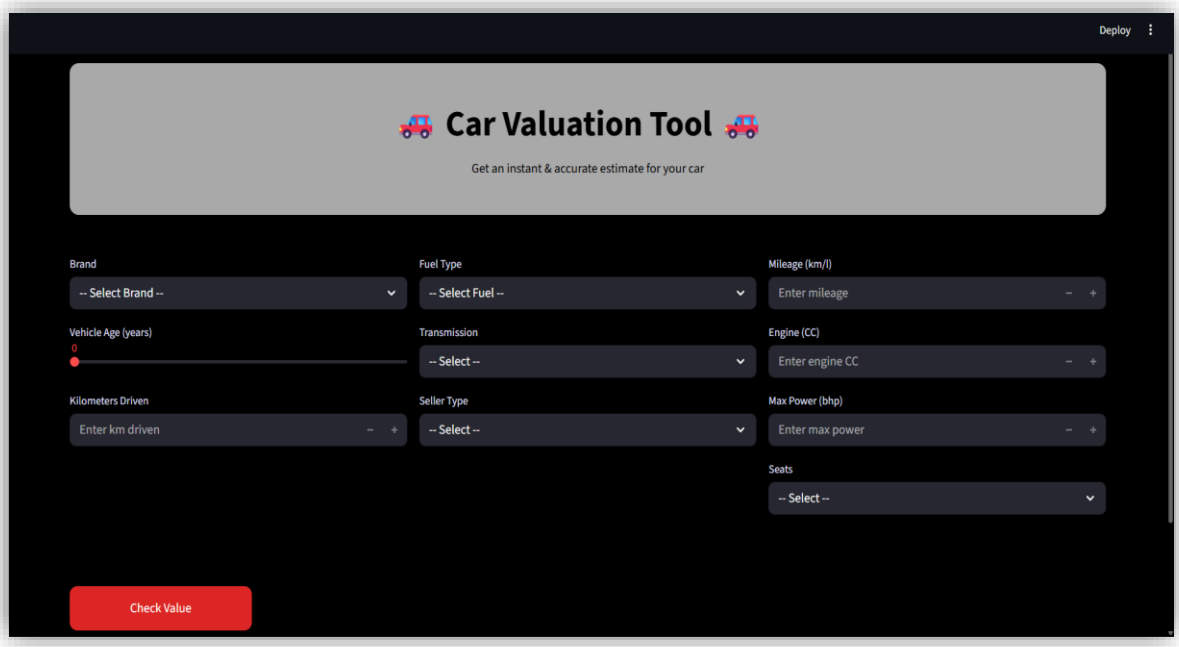
The project includes a Streamlit-based UI app

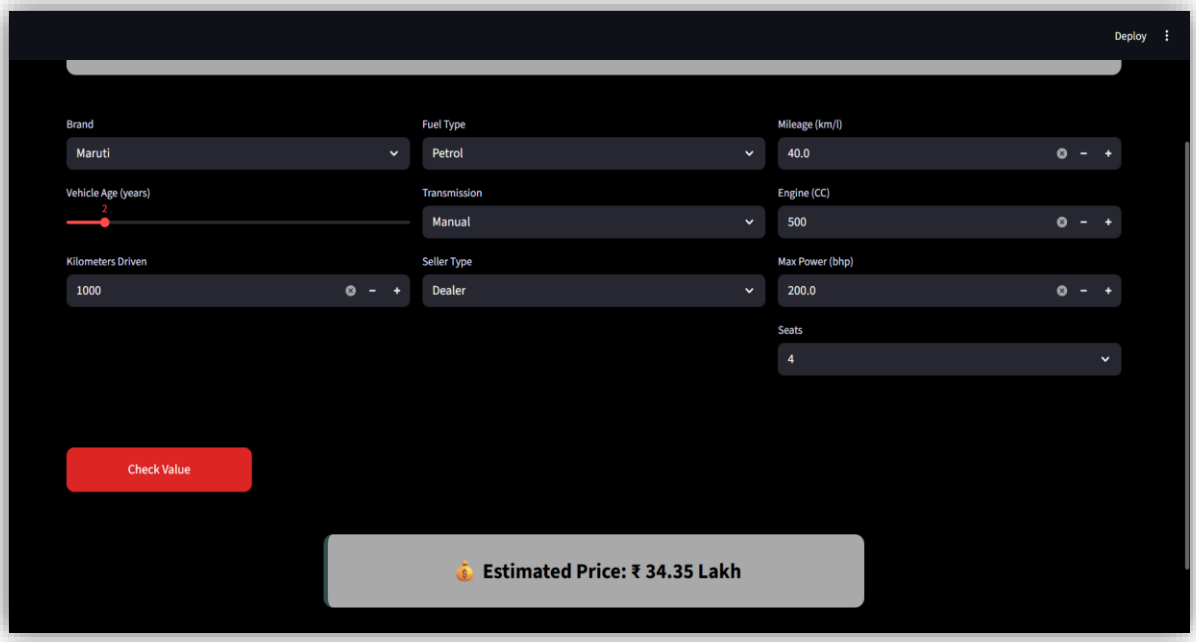
Features:

- User-friendly interface
- Input fields:
    - Brand
    - Fuel Type
    - Transmission
    - Seller Type
    - Vehicle Age
    - KM Driven
    - Mileage

- Engine
- Max Power
- Seats

- Button: "Check Value"
- Output: Predicted price in Indian format (Lakh / Crore)





10. Key Functionalities

- Real-time car price prediction
- Automatic feature encoding
- Log transformation handling
- Indian currency formatting (₹ Lakh / Crore)
- Error handling for missing files

11. Advantages

- Fast and accurate predictions
- Easy to use interface
- Helps both buyers and sellers
- Reduces manual price estimation errors

12. Limitations

- Limited dataset size
- Only supports selected brands
- Accuracy depends on data quality
- Does not include real-time market trends

13. Future Enhancements

- Add more brands and features
- Deploy on cloud (AWS / Heroku)
- Add image-based car evaluation
- Use advanced models (XGBoost, Deep Learning)
- Real-time data integration

14. Conclusion

This project successfully demonstrates how machine learning can be used to predict used car prices with reasonable accuracy. The integration of a trained model with a web interface makes the system practical and user-friendly.