நான் முதல்வன்

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Phase-3 Submission Report

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Institution: C. Abdul Hakeem College of Engineering and Technology

Department: Computer Science and Engineering

Date of Submission: 09-05-2025

GitHub Repository Link:
https://github.com/fathima32/house-price-prediction-3.git

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1. Problem Statement

Accurate prediction of house prices is a crucial challenge in the real estate industry due to the influence of numerous factors such as location, size, amenities, and current market dynamics. Traditional models often fail to handle the non-linearity and complex interactions present in housing data, leading to suboptimal pricing insights. This project addresses the issue by applying advanced supervised regression techniques to build a robust predictive model. The aim is to support buyers, sellers, and investors with data-driven insights, thereby enhancing real estate decision-making and pricing strategies.

2. Abstract

This project focuses on predicting housing prices using smart regression models by leveraging the Ames Housing Dataset. The objective is to overcome the limitations of traditional pricing methods that often miss complex relationships in data. The dataset underwent preprocessing, exploratory data analysis, and feature engineering to improve model quality. Various models like Linear Regression, Random Forest, and XGBoost were implemented and evaluated using RMSE, MAE, and R^2-score. Among these, XGBoost provided the most accurate predictions. The outcome is a predictive system capable of estimating house

prices, assisting stakeholders in making informed real estate decisions.

3. System Requirements

Hardware: Minimum 4GB RAM, Intel i3 Processor

or above Software:

Python 3.10+

Jupyter Notebook / Google Colab

Libraries: pandas, numpy, seaborn, matplotlib, scikit-learn, xgboost, plotly

4.Objectives

Analyze influential features like area, number of rooms, amenities, and location

Preprocess and clean the dataset for high-quality input Engineer relevant features to capture hidden patterns

Develop and compare models: Linear Regression, Random

Forest, XGBoost

Evaluate models using metrics like RMSE, MAE, and R²

Identify the best model and present key insights using visualizations

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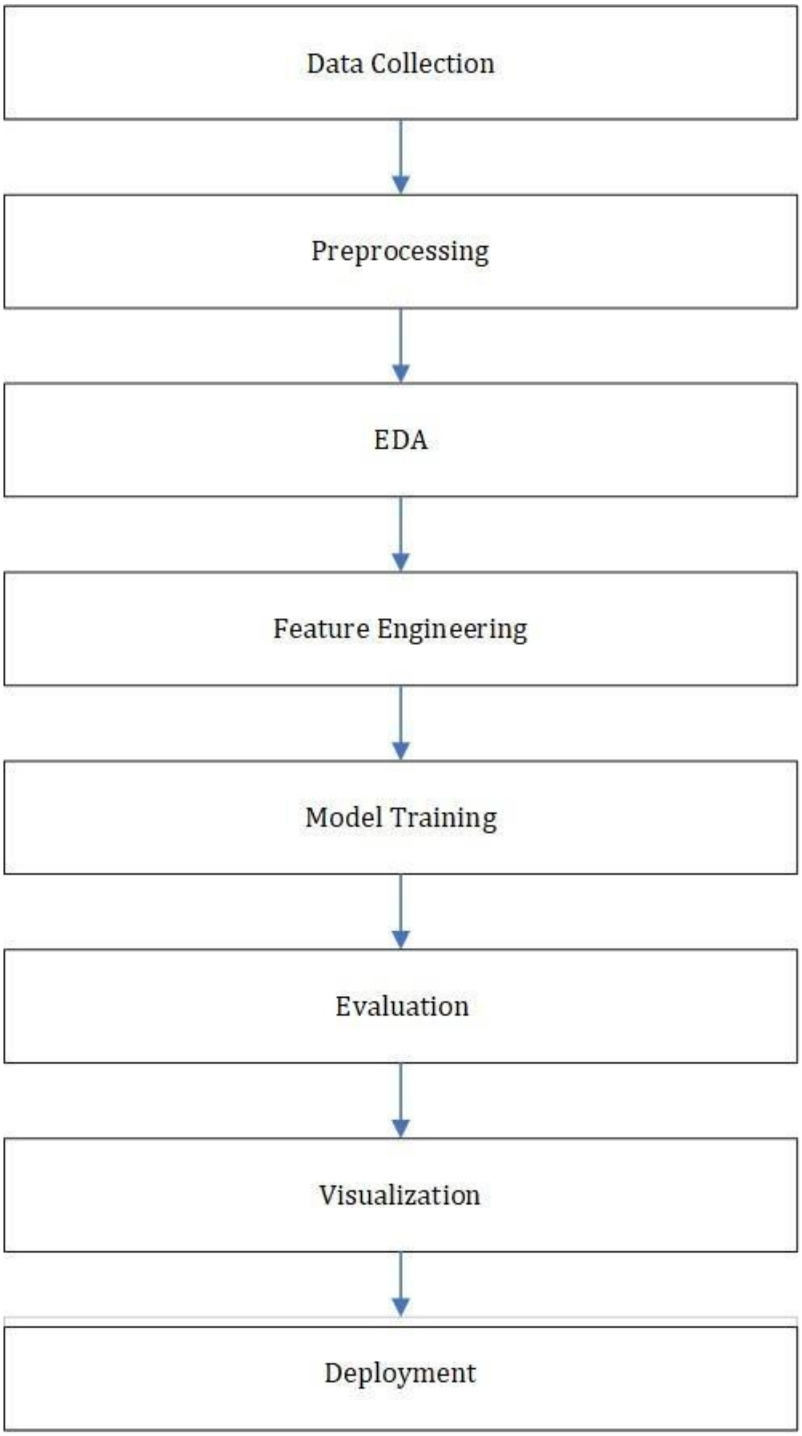
5.Flowchart of Project Workflow



6.Dataset Description

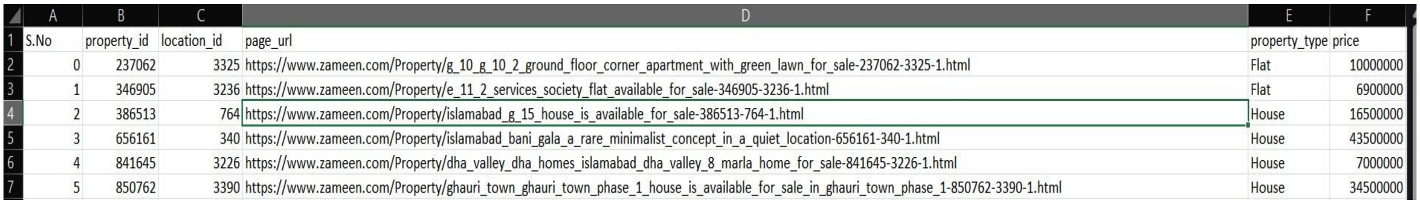
Dataset Name: Ames Housing Dataset

Source: Kaggle (https://www.kaggle.com/datasets)

Type: Public, Structured

Size: ~2,930 records with ~80 features

Target Variable: SalePrice



	A	B	C	D	E	F
1	S.No	property_id	location_id	page_url	property_type	price
2	0	237062	3325	https://www.zameen.com/Property/g_10_g_10_2_ground_floor_corner_apartment_with_green_lawn_for_sale-237062-3325-1.html	Flat	10000000
3	1	346905	3236	https://www.zameen.com/Property/e_11_2_services_society_flat_available_for_sale-346905-3236-1.html	Flat	6900000
4	2	386513	764	https://www.zameen.com/Property/islamabad_g_15_house_is_available_for_sale-386513-764-1.html	House	16500000
5	3	656161	340	https://www.zameen.com/Property/islamabad_bani_gala_a_rare_minimalist_concept_in_a_quiet_location-656161-340-1.html	House	43500000
6	4	841645	3226	https://www.zameen.com/Property/dha_valley_dha_homes_islamabad_dha_valley_8_marla_home_for_sale-841645-3226-1.html	House	7000000
7	5	850762	3390	https://www.zameen.com/Property/ghauri_town_ghauri_town_phase_1_house_is_available_for_sale_in_ghauri_town_phase_1-850762-3390-1.html	House	34500000

7.Data Preprocessing

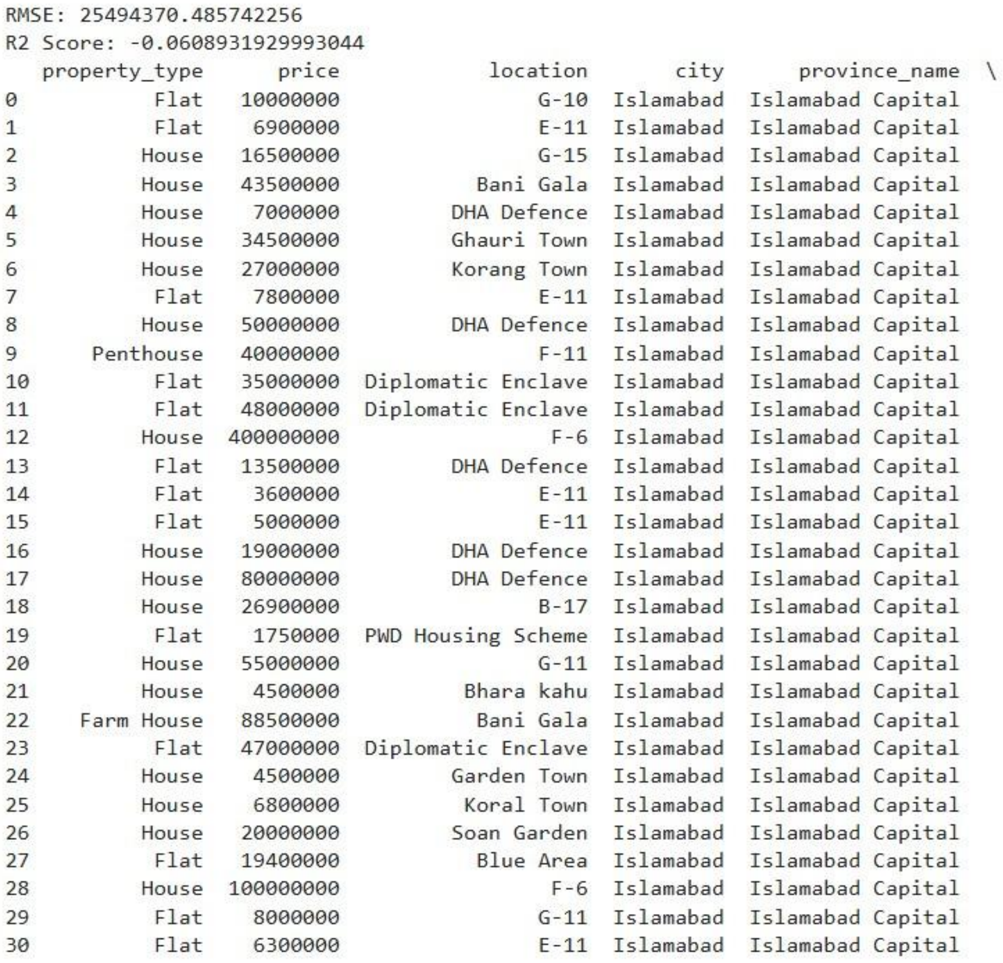
Handled missing values using mean/mode imputation

Removed duplicates and standardized column formats

Treated outliers using IQR method

Encoded categorical variables using One-Hot Encoding

Scaled features using Min-Max and Standard Scalers



```
RMSE: 25494370.485742256
R2 Score: -0.0608931929993044
   property_type      price            location       city      province_name  \
0           Flat   10000000                G-10  Islamabad  Islamabad Capital
1           Flat    6900000                E-11  Islamabad  Islamabad Capital
2          House   16500000                G-15  Islamabad  Islamabad Capital
3          House   43500000           Bani Gala  Islamabad  Islamabad Capital
4          House    7000000         DHA Defence  Islamabad  Islamabad Capital
5          House   34500000         Ghauri Town  Islamabad  Islamabad Capital
6          House   27000000         Korang Town  Islamabad  Islamabad Capital
7           Flat    7800000                E-11  Islamabad  Islamabad Capital
8          House   50000000         DHA Defence  Islamabad  Islamabad Capital
9      Penthouse   40000000                F-11  Islamabad  Islamabad Capital
10          Flat   35000000  Diplomatic Enclave  Islamabad  Islamabad Capital
11          Flat   48000000  Diplomatic Enclave  Islamabad  Islamabad Capital
12         House  400000000                 F-6  Islamabad  Islamabad Capital
13          Flat   13500000         DHA Defence  Islamabad  Islamabad Capital
14          Flat    3600000                E-11  Islamabad  Islamabad Capital
15          Flat    5000000                E-11  Islamabad  Islamabad Capital
16         House   19000000         DHA Defence  Islamabad  Islamabad Capital
17         House   80000000         DHA Defence  Islamabad  Islamabad Capital
18         House   26900000                B-17  Islamabad  Islamabad Capital
19          Flat    1750000  PWD Housing Scheme  Islamabad  Islamabad Capital
20         House   55000000                G-11  Islamabad  Islamabad Capital
21         House    4500000          Bhara kahu  Islamabad  Islamabad Capital
22    Farm House   88500000           Bani Gala  Islamabad  Islamabad Capital
23          Flat   47000000  Diplomatic Enclave  Islamabad  Islamabad Capital
24         House    4500000         Garden Town  Islamabad  Islamabad Capital
25         House    6800000          Koral Town  Islamabad  Islamabad Capital
26         House   20000000         Soan Garden  Islamabad  Islamabad Capital
27          Flat   19400000          Blue Area  Islamabad  Islamabad Capital
28         House  100000000                 F-6  Islamabad  Islamabad Capital
29          Flat    8000000                G-11  Islamabad  Islamabad Capital
30          Flat    6300000                E-11  Islamabad  Islamabad Capital
```

8.Exploratory Data Analysis (EDA)

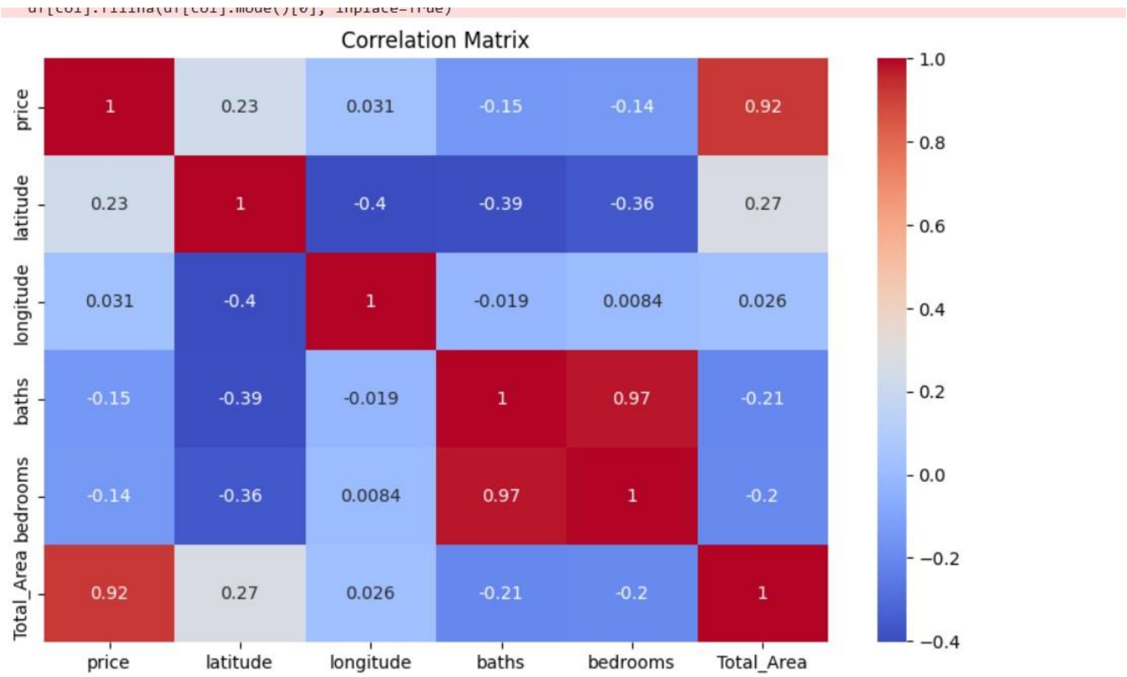
Univariate Analysis: Histograms and boxplots showed skewed distributions in price and area

Bivariate Analysis: Strong correlation between GrLivArea and

SalePrice

Multivariate Analysis: Heatmaps showed multicollinearity; scatter plots revealed non-linear trends

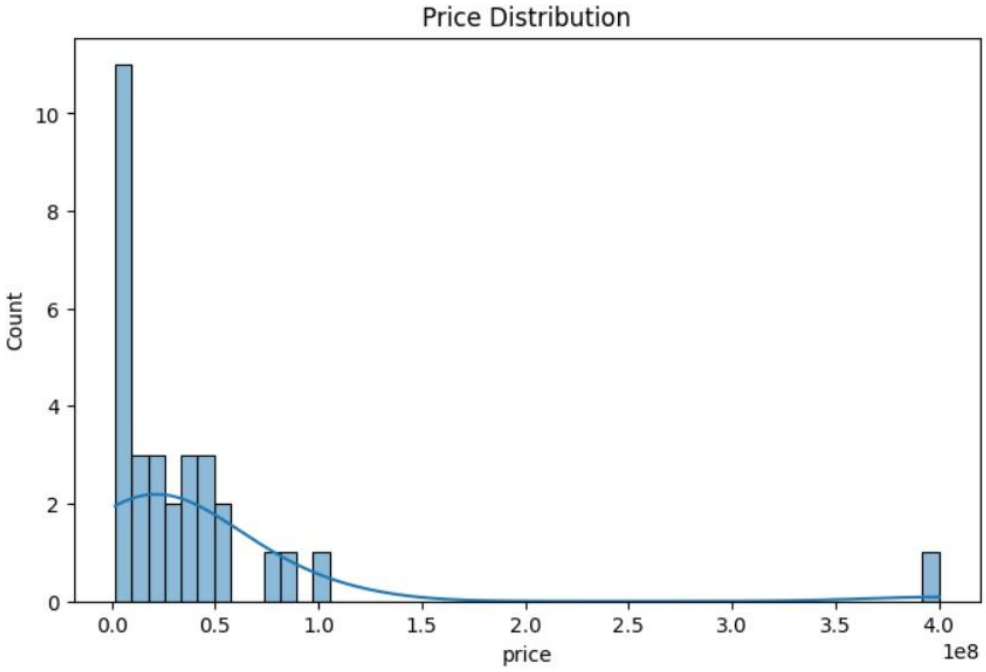
Insights: OverallQual, GrLivArea, and Neighborhood are top influencing factors



```
df[col].fillna(df[col].mode()[0], inplace=True)
```

Correlation Matrix

	price	latitude	longitude	baths	bedrooms	Total_Area
price	1	0.23	0.031	-0.15	-0.14	0.92
latitude	0.23	1	-0.4	-0.39	-0.36	0.27
longitude	0.031	-0.4	1	-0.019	0.0084	0.026
baths	-0.15	-0.39	-0.019	1	0.97	-0.21
bedrooms	-0.14	-0.36	0.0084	0.97	1	-0.2
Total_Area	0.92	0.27	0.026	-0.21	-0.2	1



9.Feature Engineering

Created: HouseAge = YearSold - YearBuilt,
PricePerSqFt =
SalePrice / TotalSqFeet

Encoded categorical features

Applied log transformation to reduce skewness

Removed low-importance features with high null values

10.Model Building

Models Used:

Linear Regression

Ridge & Lasso Regression

Decision Tree Regressor

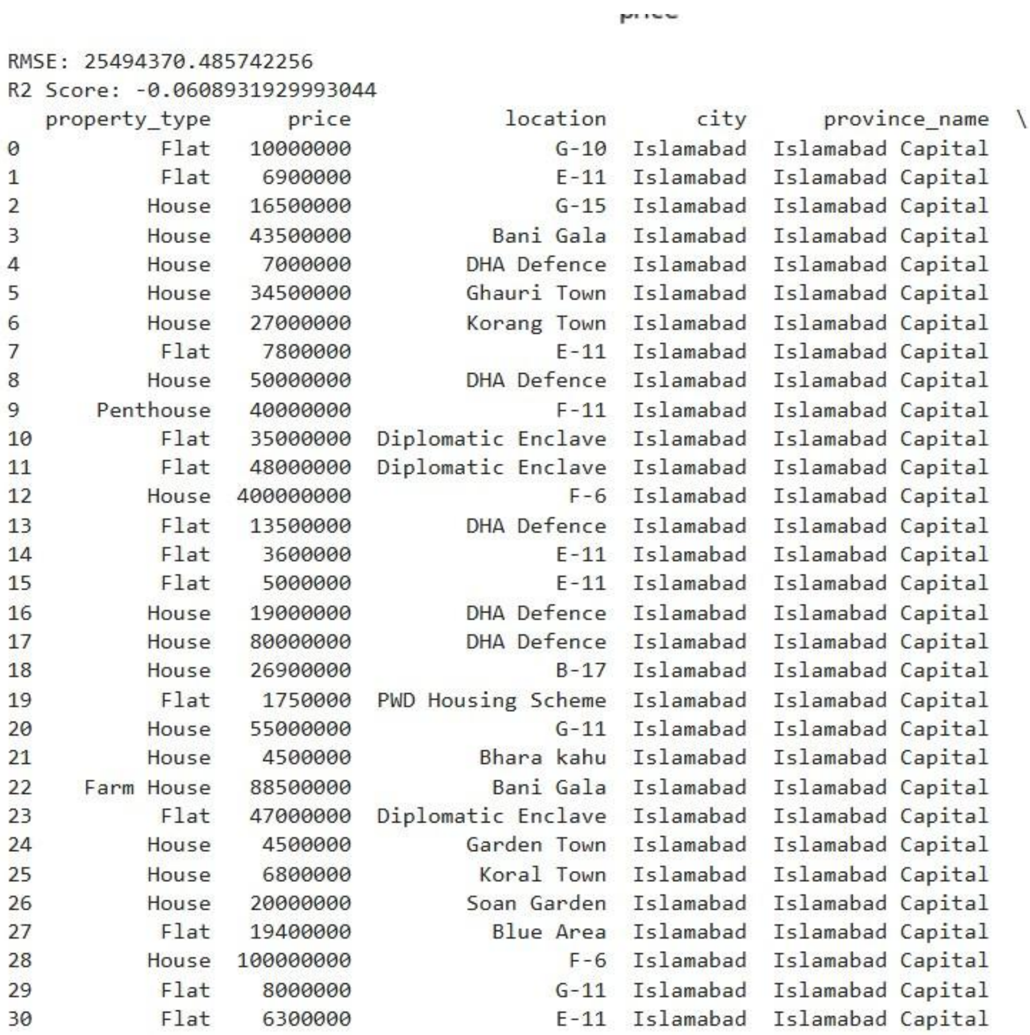
Random Forest Regressor

XGBoost Regressor

Evaluation Metrics: RMSE, MAE, R²-score

Cross-Validation: 10-Fold CV

Best Model: XGBoost due to handling of non-linearity and feature interactions



```
                                                   price
RMSE: 25494370.485742256
R2 Score: -0.0608931929993044
   property_type      price            location       city      province_name  \
0           Flat   10000000                G-10  Islamabad  Islamabad Capital
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18         House   26900000                B-17  Islamabad  Islamabad Capital
19          Flat    1750000  PWD Housing Scheme  Islamabad  Islamabad Capital
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30          Flat    6300000                E-11  Islamabad  Islamabad Capital
```
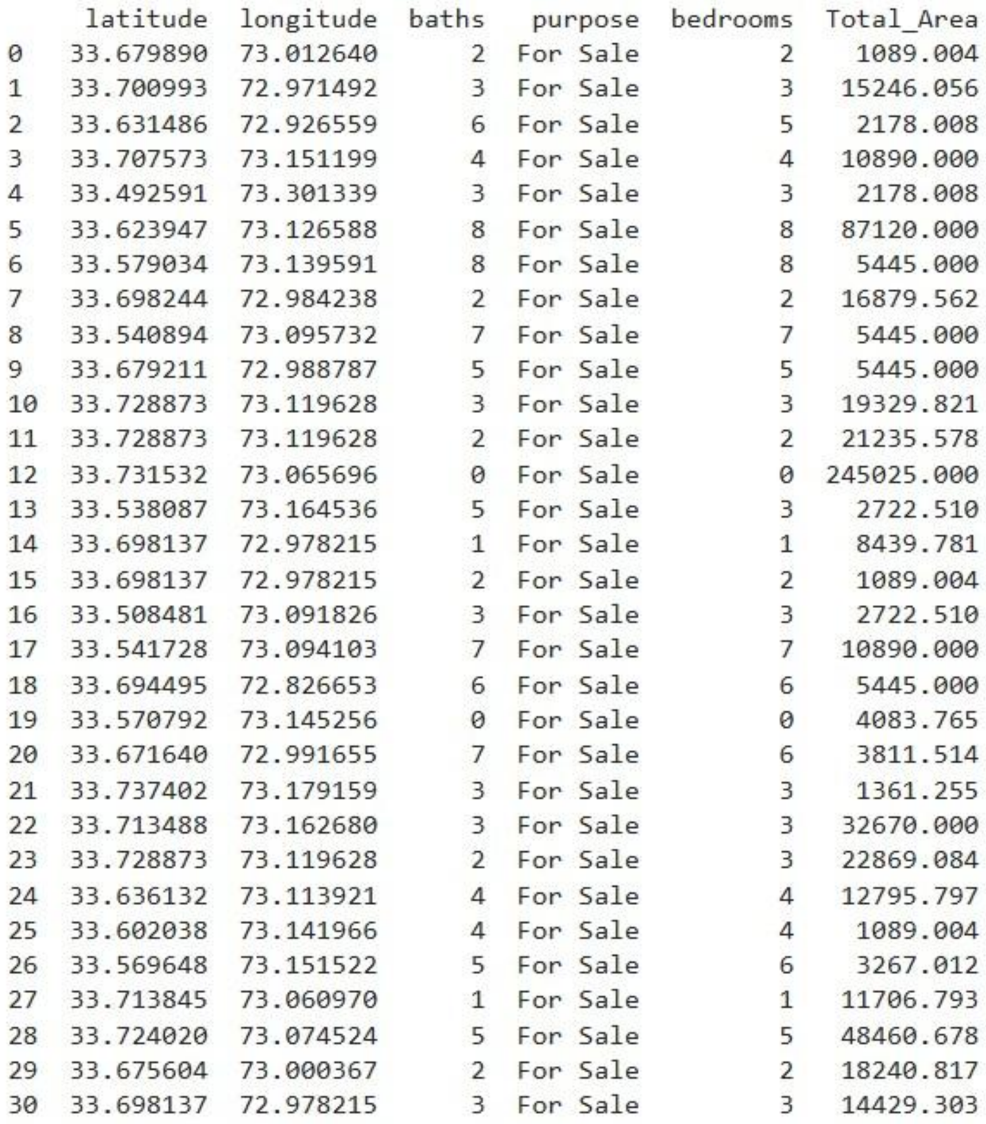



```
    latitude  longitude  baths  purpose  bedrooms  Total_Area
0   33.679890  73.012640      2  For Sale         2    1089.004
1   33.700993  72.971492      3  For Sale         3   15246.056
2   33.631486  72.926559      6  For Sale         5    2178.008
3   33.707573  73.151199      4  For Sale         4   10890.000
4   33.492591  73.301339      3  For Sale         3    2178.008
5   33.623947  73.126588      8  For Sale         8   87120.000
6   33.579034  73.139591      8  For Sale         8    5445.000
7   33.698244  72.984238      2  For Sale         2   16879.562
8   33.540894  73.095732      7  For Sale         7    5445.000
9   33.679211  72.988787      5  For Sale         5    5445.000
10  33.728873  73.119628      3  For Sale         3   19329.821
11  33.728873  73.119628      2  For Sale         2   21235.578
12  33.731532  73.065696      0  For Sale         0  245025.000
13  33.538087  73.164536      5  For Sale         3    2722.510
14  33.698137  72.978215      1  For Sale         1    8439.781
15  33.698137  72.978215      2  For Sale         2    1089.004
16  33.508481  73.091826      3  For Sale         3    2722.510
17  33.541728  73.094103      7  For Sale         7   10890.000
18  33.694495  72.826653      6  For Sale         6    5445.000
19  33.570792  73.145256      0  For Sale         0    4083.765
20  33.671640  72.991655      7  For Sale         6    3811.514
21  33.737402  73.179159      3  For Sale         3    1361.255
22  33.713488  73.162680      3  For Sale         3   32670.000
23  33.728873  73.119628      2  For Sale         3   22869.084
24  33.636132  73.113921      4  For Sale         4   12795.797
25  33.602038  73.141966      4  For Sale         4    1089.004
26  33.569648  73.151522      5  For Sale         6    3267.012
27  33.713845  73.060970      1  For Sale         1   11706.793
28  33.724020  73.074524      5  For Sale         5   48460.678
29  33.675604  73.000367      2  For Sale         2   18240.817
30  33.698137  72.978215      3  For Sale         3   14429.303
```

11.Model Evaluation

Metrics:

RMSE: Lowest for XGBoost

MAE: Moderate error margin

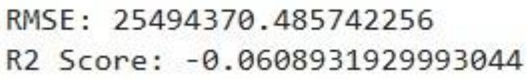
R²-score: ~0.91 for XGBoost

Visuals:

Residual plots

Model comparison bar chart

SHAP values (optional)



```
RMSE: 25494370.485742256
R2 Score: -0.0608931929993044
```

12.Source Code

```
# 1. Import Libraries import pandas as pd
import numpy as np import
matplotlib.pyplot as plt import seaborn as
sns from sklearn.model_selection import
train_test_split from
sklearn.preprocessing import
StandardScaler, OneHotEncoder
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline from
sklearn.impute import SimpleImputer from
sklearn.ensemble import
RandomForestRegressor from sklearn.metrics
import mean_squared_error, r2_score


# 2. Load Dataset
df = pd.read_excel("Forcasting house datasets.xlsx",
sheet_name="Sheet1")


# 3. Data Cleaning
# Drop
```

```
unnecessary
columns
df.drop(columns=['S.No', 'property_id', 'location_id',
'page_url', 'agency', 'agent'], inplace=True)


# Drop rows with missing target
variable
df = df.dropna(subset=['price'])


# Fill missing values
num_cols = df.select_dtypes(include=['float64',
'int64']).columns
cat_cols = df.select_dtypes(include=['object']).columns

for col in num_cols:
    df[col].fillna(df[col].median(), inplace=True)

for col in cat_cols:
    df[col].fillna(df[col].mode()[0], inplace=True)



# 4. EDA (Exploratory Data
Analysis)
# Plot correlations
```

```
plt.figure(figsize=(10, 6))
sns.heatmap(df.corr(numeric_only=True), annot=True,
cmap='coolwarm')
plt.title('Correlation Matrix')
plt.show()




# Plot price distribution
plt.figure(figsize=(8, 5))
sns.histplot(df['price'], bins=50, kde=True)
plt.title('Price Distribution')
plt.show()



# 5. Feature
Engineering X =
df.drop('price',
axis=1)
y = df['price']


# Separate features by type
numerical_features = X.select_dtypes(include=['int64',
'float64']).columns.tolist()
categorical_features =
X.select_dtypes(include=['object']).columns.tolist()



# 6. Preprocessing Pipeline
numeric_transformer = Pipeline([
    ('imputer', SimpleImputer(strategy='median')),
    ('scaler', StandardScaler())
])

categorical_transformer = Pipeline([
    ('imputer', SimpleImputer(strategy='most_frequent')),
('onehot', OneHotEncoder(handle_unknown='ignore'))
])

preprocessor = ColumnTransformer([
    ('num', numeric_transformer, numerical_features),
    ('cat', categorical_transformer, categorical_features)
])
```

```
# 7.
Modeling
model =
Pipeline([
    ('preprocessor', preprocessor),
    ('regressor', RandomForestRegressor(n_estimators=100,
random_state=42))
])


# Split the data
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)


# Train the model
model.fit(X_train, y_train)




# Predict and
Evaluate y_pred =
model.predict(X_test
)
print("RMSE:", np.sqrt(mean_squared_error(y_test, y_pred)))
print("R2 Score:", r2_score(y_test,
y_pred)) print(df)
```

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13.Future Scope

Implement real-time price prediction using a Streamlit web app

Integrate more external datasets for enhanced accuracy

Use deep learning models (e.g., neural networks) for comparison

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14.Team Members and Roles

1.Jamal Be Fathima [510623104033]

Role: Team Lead & Model Building

Task: Led the project and implemented all regression models

2.Alfiya Amreen. T [510623104007]

Role: Data Collection & Preprocessing

Task: Handled dataset sourcing and cleaning

3.Farah Thasleem. S [510623104022]

Role: EDA & Feature Engineering

Task: Conducted EDA and created new features

4.Jansi Rani. K. S [510623104034]

Role: Model Evaluation & Report Preparation

Task: Evaluated models and compiled documentation
