Phase-3 Submission Template

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Department: Computer Science and Engineering

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GitHub Repository Link:

https://github.com/rabbani0/house-price-prediction-3.git

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1. Problem Statement

Accurate house price estimation is a key challenge in the real estate industry. Traditional valuation methods often rely on subjective expertise, which may introduce inconsistencies.

This project addresses the problem using supervised regression techniques to build a data-driven, objective, and accurate predictive model that can aid buyers, sellers, investors, and financial institutions.

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2. Abstract

The goal of this project is to predict house prices based on various features like location, size, and quality using machine learning. We processed a structured dataset, performed EDA, engineered meaningful features, and built multiple regression models including Linear Regression, Random Forest, and XGBoost. The XGBoost model performed best, yielding high R^2 and low error metrics. The model was also deployed via Streamlit to allow real-time predictions. This system can significantly assist real estate stakeholders in making informed decisions.

3.

System Requirements

Hardware:

- Minimum: 4GB RAM, i3 processor
- Recommended: 8GB RAM, i5/i7 processor

Software:

- Python 3.9+
- IDE: Google Colab / Jupyter Notebook
- Libraries: pandas, numpy, matplotlib, seaborn, scikitlearn, xgboost, lightgbm, streamlit

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5.

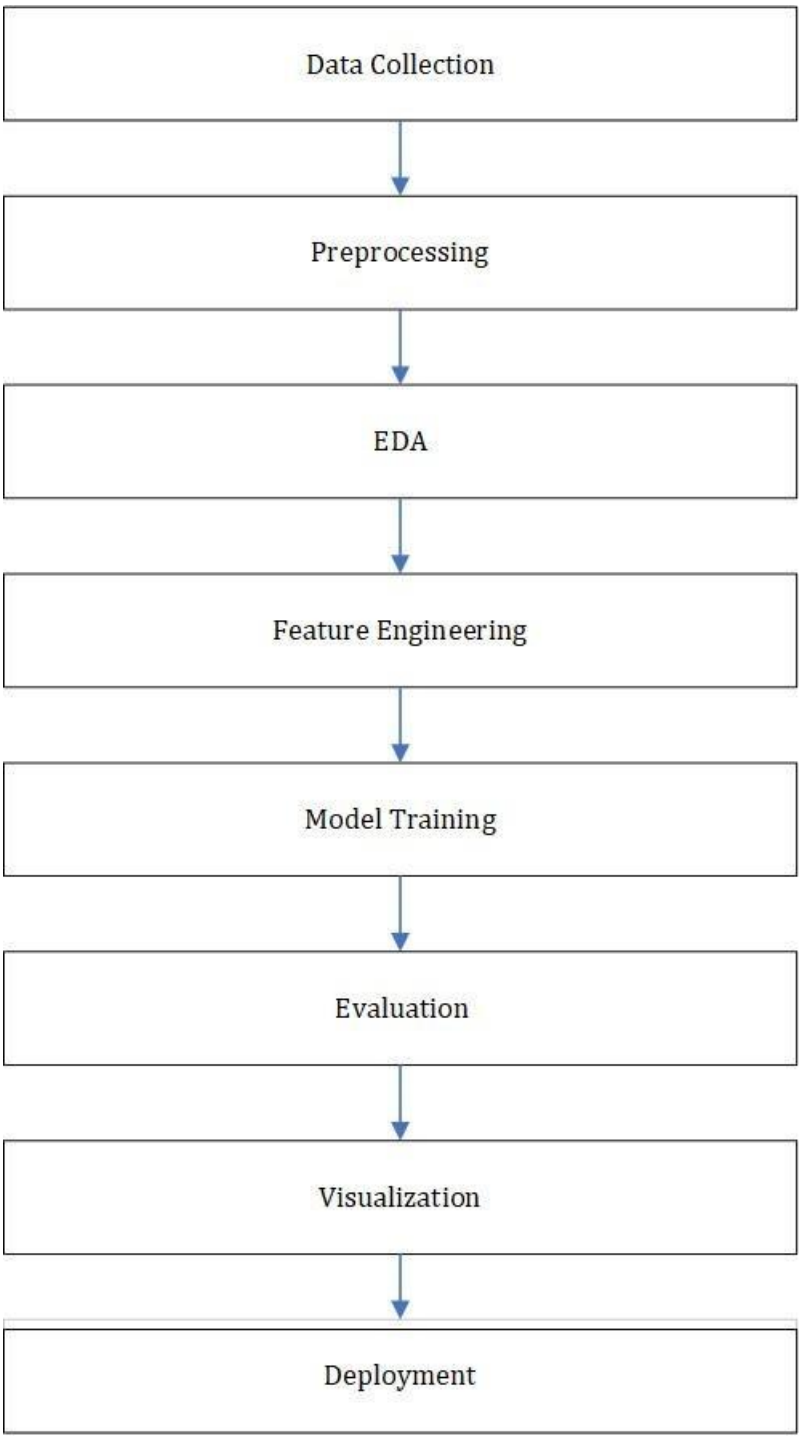
Objectives

- Analyze how housing features influence price.
- Apply regression models and compare their performance.
- Identify the best-performing algorithm.
- Interpret model results and visualize key insights.
- (Optional) Deploy the model for public use.

6.

7.

Flowchart of Project Workflow



8.

Dataset Description

- Source: Kaggle(https://www.kaggle.com/datasets/yasserh/housing-prices-dataset?resource=download)
  - House Prices: Advanced Regression Techniques

- Type: Public, static

- Size: ~2,930 rows and 80 columns

- 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

9.

Data Preprocessing

- Handled missing values using:
- Mean/median (numerical)
- Mode (categorical)
- Removed duplicate records and high-null columns
- One-Hot Encoded categorical variables
- Scaled numeric features using MinMaxScaler
- Outliers treated using IQR method

10.

```
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
```

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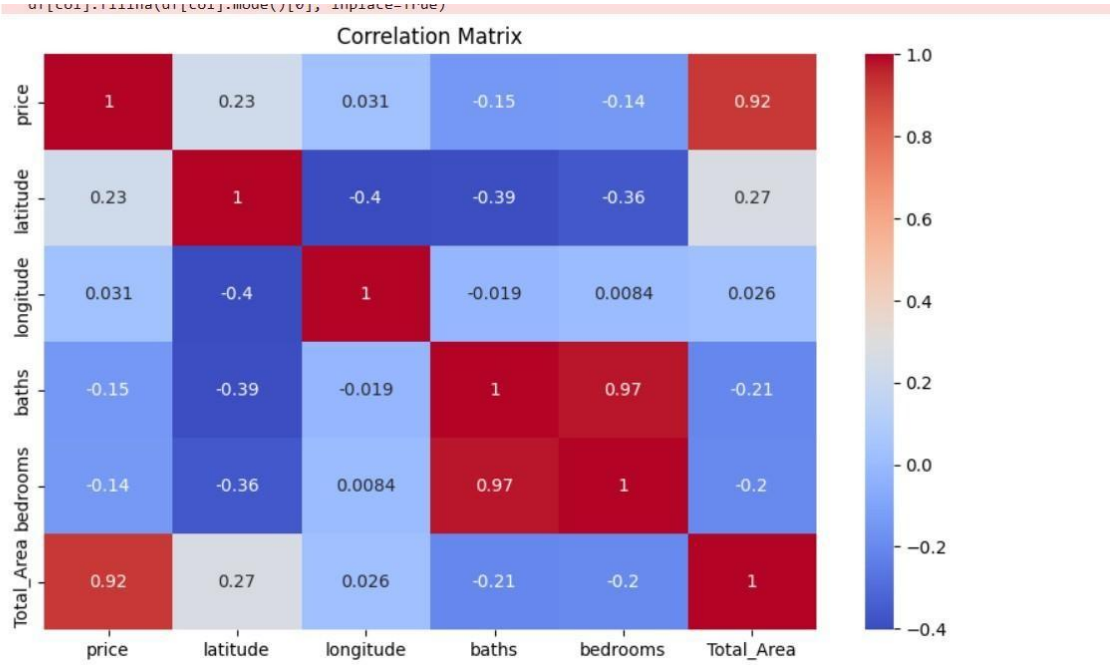
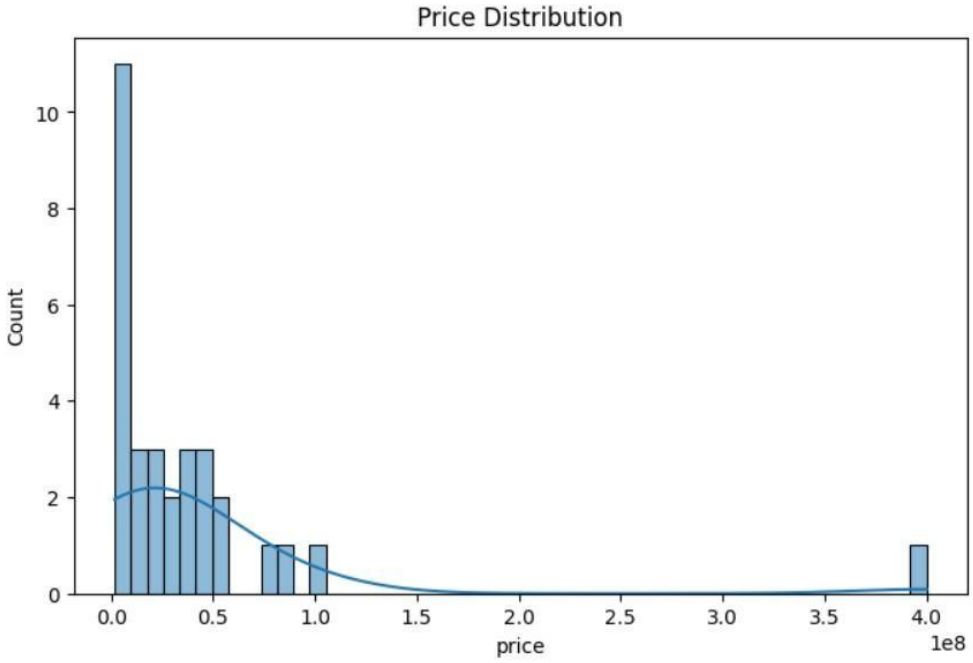
8. Exploratory Data Analysis (EDA)

- Univariate: Distribution plots for SalePrice, LotArea
- Bivariate: Scatter plots, heatmaps show strong correlation with OverallQual, GrLivArea, Neighborhood
- Multicollinearity: Checked using correlation matrix

Key Insights:

- Quality, size, and location are dominant predictors.
- Outliers affect sale price variance.





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9. Feature Engineering

- Created new features:
- HouseAge = YrSold - YearBuilt
- TotalSF = 1stFlrSF + 2ndFlrSF + TotalBsmtSF
- Log-transformed skewed features
- Removed redundant or low-variance columns
- Categorical encoding via One-Hot Encoding

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10. Model Building

Models tested:

- Linear Regression
- Ridge and Lasso
- Decision Tree Regressor
- Random Forest Regressor
- XGBoost and LightGBM

Best Model: XGBoost — achieved the highest R^2 and lowest MAE/RMSE

price

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	
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29	Flat	8000000	G-11	Islamabad	Islamabad Capital	
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

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11. Model Evaluation

Evaluation Metrics:

- MAE, RMSE, R^2 Score
- 10-Fold Cross Validation applied

Visuals:

- Residual plots
- Actual vs Predicted scatter plot
- Feature importance from XGBoost

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

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12. Deployment

- Platform: Streamlit Cloud

- Method: Model serialized with joblib and deployed with a web UI

- Public Link: [Insert live URL if available]

- UI Screenshot: [Insert Streamlit UI screenshot]

- Sample Output: User inputs features → predicted price displayed instantly

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13. 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
Cleanin g
# Drop
unnece ssary
column
s
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
Engineeri ng
X =
df.drop('p
rice', 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())
])
cat
ego
rica
l_tr
ans
for
me
```

```
r =
Pip
elin
e([
   ('imputer',
SimpleImputer(strategy='most_frequent')),
('onehot', OneHotEncoder(handle_unknown='ignore'))
])

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


 # 7.
Mo deli
ng mo
del
=
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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14. Future Scope

- Incorporate real-time housing data using APIs.

- Extend to rental price prediction.
- Add geospatial visualization using interactive maps.
- Include economic indicators for enhanced forecasting.

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15. Team Members and Roles

- Rohan Emmanuel – Project Lead, Final Report
- Syed Zaid Ahmed – Data Collection & Cleaning
- Syed Rabbani – Exploratory Data Analysis
- Syed Nouman – Feature Engineering

- Vikram – Model Development

- Sugesh – Evaluation & Visualization
