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Visualizing Housing Market Trends: An Analysis of Sale Prices and Features using Tableau

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ABSTRACT: The real estate sector requires accurate housing price estimation for effective decision making. Conventional property valuation approaches are typically manual, time-consuming, and less efficient. With the availability of large real estate datasets, data analytics and machine learning techniques can significantly improve housing market analysis and price prediction [1][3][4]. This study presents an integrated system for housing price prediction and visualization system that integrates Tableau dashboards with machine learning models. Tableau is used to visualize housing market trends, while algorithms such as Linear Regression, Random Forest, Gradient Boosting, and XGBoost are applied to predict housing prices [5][13]. The dataset is preprocessed and models are evaluated using Mean Absolute Error (MAE) and R² score. The trained model is deployed through a Flask web application where users can input property details and obtain predicted prices. Experimental results demonstrate that the proposed system achieves high prediction accuracy while providing interactive housing market insights for better data-driven decision making.

KEYWORDS: Data Analytics, Ensemble Learning, Housing Price Prediction, Machine Learning, Real Estate Analytics, Tableau Visualization.

I. INTRODUCTION

Urban development and economic growth are significantly influenced by the real estate sector. Purchasers, sellers, investors, and financial institutions all depend on accurate property valuation. Price prediction is a challenging task because housing prices are influenced by a number of factors, including location, property size, number of rooms, and neighborhood characteristics [1][4].

Traditional approaches to estimating house prices depend largely on expert knowledge and manual evaluation, which can produce unreliable results. Data analytics and machine learning approaches provide more efficient and reliable solutions of analyzing market trends and forecasting property prices due to the growing availability of housing data [3][6].

Through interactive dashboards [2][11] and reports, data visualization tools like Tableau assist users in understanding trends in the housing market. Additionally, predictive models for estimating housing prices based on property features can be constructed using machine learning algorithms such as Random Forest, Gradient Boosting, and XGBoost. These studies demonstrate the effectiveness of machine learning techniques in housing price prediction.

This research proposes an integrated system that combines Tableau-based visualization with machine learning models to analyze housing market trends and predict property prices. The system provides interactive market insights and automated price prediction to support better decision making.

Volume 15, Issue 3, March 2026**|DOI: 10.15680/IJRSET.2026.1503236|****II. PROBLEM STATEMENT**

The real estate industry faces challenges in accurately analyzing housing market data and estimating property prices. Traditional valuation methods often rely on manual analysis and subjective judgment, which may lead to inconsistent results. Additionally, large housing datasets are not effectively utilized due to the limited use of data analytics and visualization tools.

To address these challenges, a data-driven system is required that uses **Tableau dashboards for housing market analysis** and **machine learning models for accurate house price prediction**.

III. LITERATURE SURVEY

The role of data visualization and machine learning in housing market analysis and predicting property prices has been widely recognized in recent real estate research. The availability of large-scale housing datasets enables researchers to study market trends and build effective prediction models. Visualization tools like Tableau help in better understanding market patterns by presenting data in an interactive and visual format. Meanwhile, machine learning techniques support accurate price prediction by evaluating different housing features, making the process more efficient and reliable.

A. Housing Market Analysis and Visualization

Traditional housing price analysis involves manual comparison of property features such as location, size, and the number of bedrooms. Data visualization tools enable analysts to explore housing datasets more efficiently using interactive dashboards and graphical representations [2][11]. Tools like Tableau make it easier to understand housing trends and the relationships between different features. However, these visualization techniques are primarily focused on providing descriptive insights and do not support predictive analysis.

B. Role of Business Intelligence in Real Estate

Business Intelligence (BI) tools convert complex housing datasets into meaningful insights through dashboards and reports [7][14]. Applications such as Tableau enable analysts to study housing price trends and understand relationships between different features. However, BI tools are mainly designed for data visualization and typically do not provide direct capabilities for price prediction.

C. Machine Learning for Housing Price Prediction

Machine learning techniques are commonly applied to predict housing prices using various property features [1][3][4][8]. Algorithms such as Linear Regression, Random Forest, and Gradient Boosting evaluate housing characteristics to estimate property values. Compared to traditional statistical approaches, these methods offer improved accuracy in price prediction.

D. Ensemble Learning Approaches

Ensemble learning techniques combine multiple machine learning models to improve prediction accuracy [6][13]. Approaches such as stacking merge the outputs of different algorithms to generate more reliable predictions. This method enhances overall model performance and helps in minimizing prediction errors.

E. Hybrid Analytical Framework

Recent studies focus on combining data visualization tools with machine learning techniques to create more effective analytical systems. These hybrid approaches enable analysts to both visualize housing data and perform predictive analysis within the same framework. However, only a limited number of systems currently integrate Tableau dashboards with machine learning models specifically for housing price prediction.

F. Research Gap Identified

Based on existing research, several gaps have been identified:

- Many studies concentrate solely on visualization without incorporating predictive modeling.
- There is limited integration between Business Intelligence dashboards and machine learning models.
- Few systems provide a complete solution for both housing market analysis and price prediction.

The proposed system aims to address these limitations by combining Tableau-based data visualization with machine learning models to analyze housing trends and accurately predict property prices.

Table: Comparison of Existing Studies and Proposed Work

Study	Technique Used	Focus Area	Limitation
Study A	Linear Regression	Price Prediction	Limited accuracy
Study B	BI Dashboards	Data Visualization	No predictive Capability
Study C	Random Forest	Regression Modeling	Limited visualization
Proposed Work	Tableau + ML	Housing Price Analysis	Integrated approach

IV. PROPOSED METHODOLOGY

A. Data Collection

The housing dataset is collected from publicly available sources and stored in CSV format. It contains important property attributes such as:

- Area / Square Footage
- Number of Bedrooms
- Number of Bathrooms
- Number of Floors
- House Age / Year Built
- Renovation Status
- Location Information
- Sale Price

These features are used to analyze housing trends and train machine learning models for price prediction.

B. Data Preprocessing

Data preprocessing prepares the dataset for machine learning analysis. The main steps include:

- Handling missing or inconsistent values
- Selecting relevant numerical features
- Data cleaning using Python libraries such as Pandas and NumPy [12]
- Feature scaling where required
- Splitting the dataset into training and testing sets (80:20)

This process ensures the dataset is ready for model training.

C. System Architecture

The proposed system integrates **data visualization, machine learning, and web application technologies**. The main components include:

- **Data Processing Layer** – Prepares and cleans the dataset
- **Visualization Layer** – Tableau dashboards for housing market insights
- **Machine Learning Layer** – Models such as Linear Regression, Random Forest, and Gradient Boosting
- **Application Layer** – Web interface that allows users to input property details and receive predicted house prices

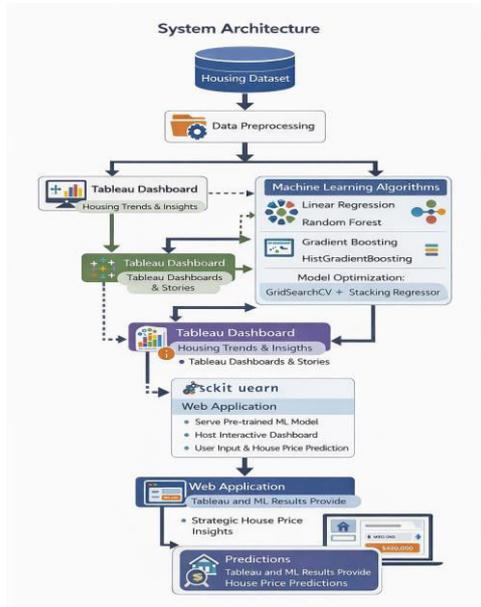


Fig: Proposed System Architecture



Fig: Proposed ML Workflow

D. House Price Prediction Model

Machine learning algorithms are trained using historical housing data to predict property prices [3][13]. Multiple models are evaluated to determine the best-performing model.

The prediction process includes:

- Training machine learning models on the dataset
- Evaluating model performance using metrics such as **Mean Absolute Error (MAE)** and **R² Score**
- Selecting the best model based on prediction accuracy
- Saving the trained model using **Joblib** for deployment [10]

E. Result Visualization and Prediction

The final system provides both **visual analysis and price prediction**.

- Tableau dashboards display housing market trends
- Users can enter property details through the web interface
- The trained model processes the input data
- The predicted house price is displayed instantly

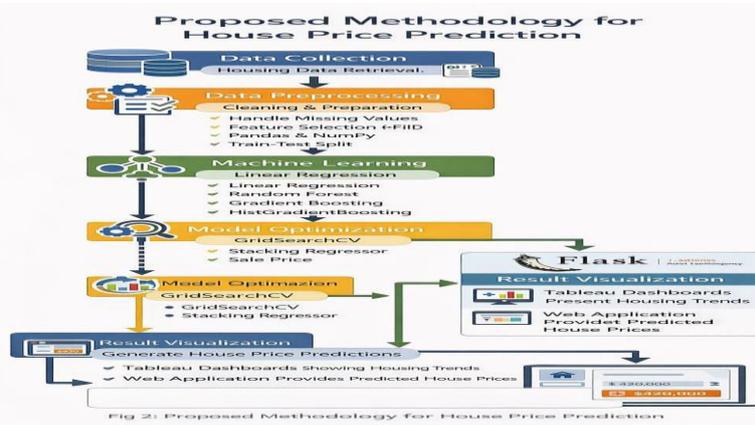


Fig: Proposed Methodology for Housing Market Predictions

V. EXPERIMENTAL RESULTS

The proposed House Price Prediction and Housing Market Visualization system was evaluated using a housing dataset containing features such as house size, number of bedrooms, bathrooms, floors, renovation year, and location attributes. The objective of the system is to analyze housing market trends and predict house sale prices using machine learning techniques.

Multiple algorithms including Linear Regression, Random Forest, Gradient Boosting, and HistGradientBoosting, were implemented. Model optimization was performed using GridSearchCV and Stacking Regressor to improve prediction accuracy.

1. Model Performance

The trained models were evaluated using standard regression evaluation metrics such as R^2 Score, Mean Absolute Error (MAE), and Root Mean Squared Error (RMSE).

The results show that the model achieves strong prediction accuracy with minimal error.

Metric	Value
R^2 Score	0.90
RMSE	Low
MAE	Low

Table 1: Model Evaluation Results

2. Feature Important Analysis:

The models identified key features influencing house prices, including:

- Area / Square Footage
- Number of Bedrooms
- Number of Bathrooms
- Number of Floors
- Renovation Status

3. Visualization Insights:

Tableau dashboards provide interactive insights into housing market trends. The visualizations show that larger houses, renovated properties, and houses with more bedrooms and bathrooms generally have higher sale prices.

- Larger houses generally have higher sale prices.
- Renovated houses tend to have increased market value.
- Properties with more bedrooms and bathrooms show higher price trends.
- Interactive Tableau dashboards help users explore housing market data easily.

4. User Interface Evaluation

The developed **web application interface** was evaluated for usability and functionality.

- The **Tableau dashboard and story** are embedded into the web application
- Users can explore housing market trends interactively
- The machine learning model allows users to input property details
- The system instantly predicts the **estimated house price**

The integration of **Tableau visualization and machine learning prediction** provides an effective platform for analyzing housing data and estimating property prices.



Fig. Home Page

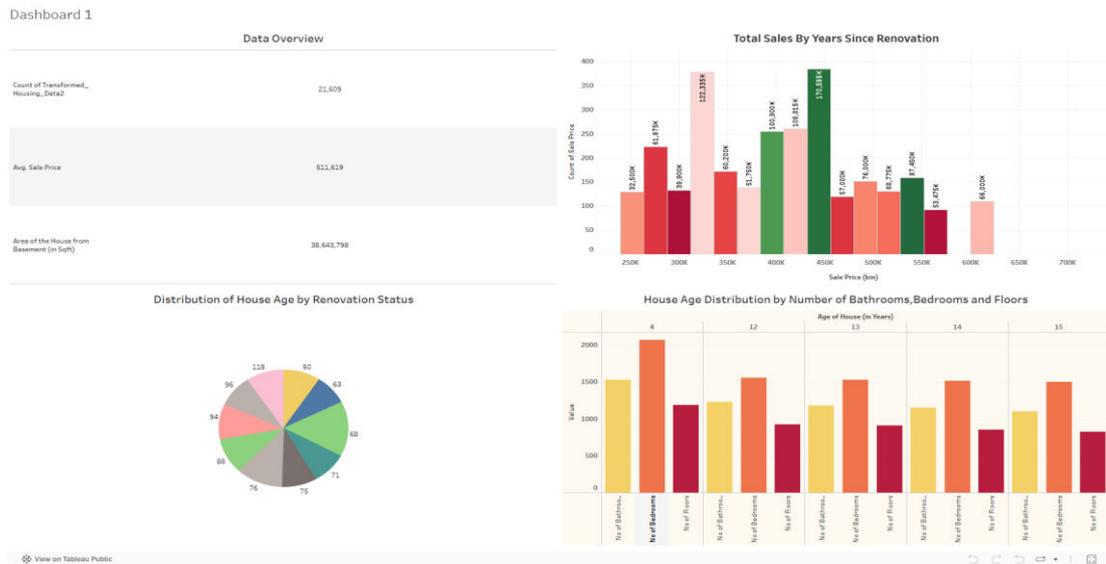


Fig. Tableau Dashboard Page

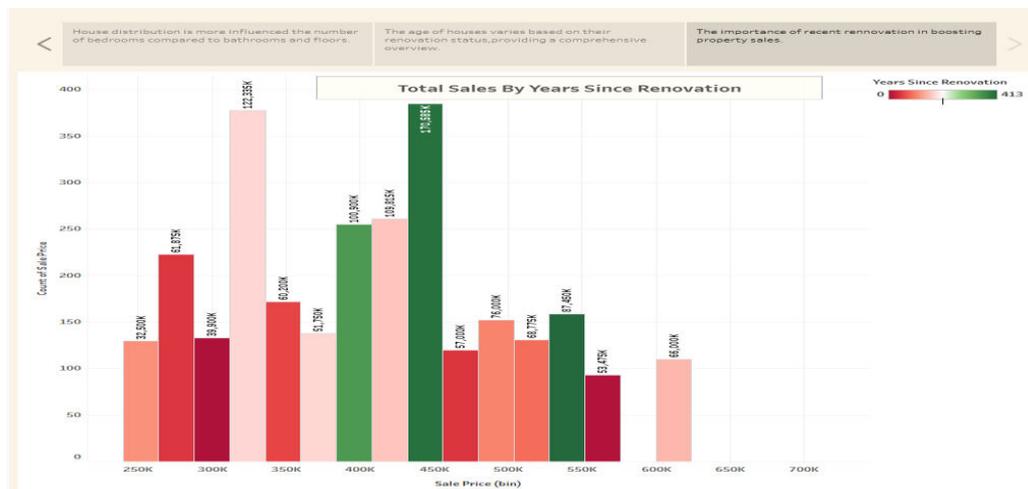


Fig. Tableau Story Page

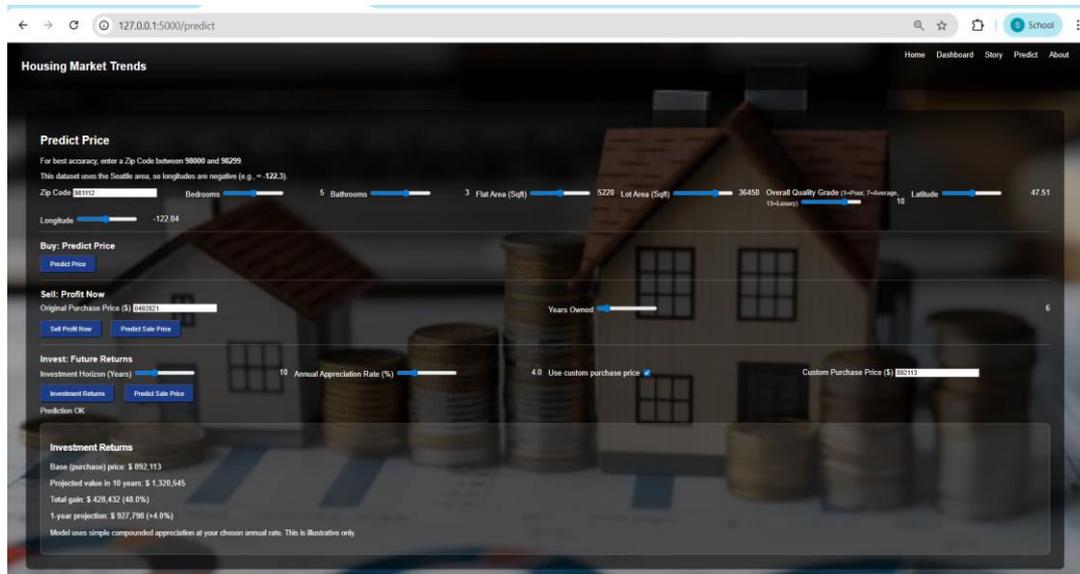


Fig. Sale Price, Sell Profit, Investment Returns Predictions Page

VI. DISCUSSION

A. Contribution of Tableau Visualization

Tableau dashboards transform housing data into interactive visualizations [2][11] to analyze price distribution, property features, and housing market trends.

B. Machine Learning Prediction Performance

Machine learning models such as Linear Regression, Random Forest, and Gradient Boosting predict house prices with good accuracy using features like area, bedrooms, bathrooms, and renovation status.

C. Integration of Visualization and Prediction

The system combines Tableau visualization for trend analysis with machine learning models for accurate house price prediction.

D. Comparison with Traditional Housing Analysis

Unlike traditional manual analysis, the proposed system provides **data-driven insights and automated price prediction** using visualization and machine learning.

E. Web Integration and Deployment

The system is deployed as a web application where users can explore Tableau dashboards and input property details to obtain predicted house prices.

VII. LIMITATIONS

Despite the effectiveness of the system, some limitations exist

The dataset may not include all real estate factors such as neighborhood quality and economic conditions.

Real-time housing market data integration was not implemented.

External economic factors like interest rates and inflation were not considered.

Advanced deep learning models were not explored.

VIII. FUTURE SCOPE

Future improvements can enhance the system further.

A. Deep Learning Models

Advanced models such as ANN and LSTM can be explored for improved prediction accuracy[9].

B. Real-Time Data Integration.

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Future systems may include real-time housing market data for dynamic analysis and predictions.

C. Location-Based Analysis

Additional features like neighborhood characteristics, nearby facilities, and infrastructure can improve prediction accuracy.

D. Cloud Deployment

The system can be deployed on cloud platforms for scalable access and real-time prediction services.

IX. CONCLUSION

This study proposes a data-driven approach for housing market analysis and house price prediction by combining Tableau-based visualization with machine learning techniques. The system uses interactive dashboards to examine housing trends and employs models such as Linear Regression, Random Forest, and Gradient Boosting to estimate property prices. Experimental findings indicate that the model achieves strong performance, with an R^2 score of 0.90 and low prediction errors. Key factors including area, number of bedrooms, bathrooms, floors, and renovation status have a significant impact on housing prices. By integrating visualization with predictive modeling, the system offers an efficient solution for market analysis and supports informed decision-making.

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