HOME PRICE PREDICTION USING MACHINE LEARNING

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ABSTRACT

The rapid expansion of the real estate industry, particularly in urban areas like Bangalore, has highlighted the need for efficient, accurate, and data-driven property valuation methods. Traditional techniques for estimating home prices often rely on manual assessments and subjective judgment, which can result in inconsistencies and lack of transparency. This paper introduces a machine learning-based predictive model designed to estimate home prices using key features such as total square footage, number of bedrooms (BHK), number of bathrooms, and geographic location. The model is trained using a structured dataset, where location is encoded using one-hot encoding to handle the city's diverse neighbourhoods, enabling the model to capture regional price variations effectively.

The implementation includes a user-friendly web application built with Python and Flask, which allows users to input property details and receive instant price estimates. A database is integrated for user authentication and data storage. The model demonstrates strong predictive performance for properties within the Bangalore region, offering valuable support for buyers, sellers, and real estate agents. By automating the valuation process, this system enhances decision-making, promotes market transparency, and reduces the time and effort traditionally required for home price estimation.

Keyword*:* *- Machine Learning, Home Price Prediction, Real Estate, Linear Regression, Location-Based Features, Flask, Python & Data Analytics.*

1. INTRODUCTION

In today's digital age, the real estate sector is evolving rapidly with the integration of artificial intelligence and machine learning techniques. Property valuation remains one of the most critical aspects of real estate operations. Traditionally, home price estimation was based on manual surveys and subjective judgment, leading to inconsistencies and inefficiencies. With the surge in data availability and computational tools, machine learning offers a powerful solution to automate and optimize this task. This paper presents a machine learning-based web application that predicts residential property prices in Bangalore based on a set of critical features: total square feet, number of bedrooms (BHK), number of bathrooms, and location. Among these, location plays a dominant role in determining real estate value, and thus, it is handled using one-hot encoding to represent the presence or absence of a location among over 240 possibilities. The system is built using Python and Flask, with a backend for user management. It offers a simple user interface for entering property details and retrieving instant price predictions. This model aims to improve pricing transparency, save time in property evaluations, and make the pricing process more accessible to common users and real estate professionals alike.

2. HOME PRICE PREDICTION SYSTEM

The **Home Price Prediction System** is a machine learning–based application designed to estimate the market value of residential properties based on various input parameters. This system provides a user-friendly interface where users can interact with the model and obtain accurate price predictions, making it useful for buyers, sellers, real estate agents, and analysts.

2.1 User Interaction Modes

Users can initiate diagnosis by selecting one of the following modes:

- **Web-Based User Interface**
  The system provides a responsive web application through which users can access the prediction model from any device, including desktops, laptops, tablets, or smartphones.
- **Structured Input Mechanism**
  Users enter property details via structured forms, which include dropdown menus (for location and number of bedrooms) and numeric fields (for square footage and bathrooms). This ensures accurate and easy data entry.
- **Interactive Prediction Trigger**
  After providing the necessary inputs, users simply click the **"Predict"** button. The system processes the data and immediately displays the estimated home price without needing page reloads.
- **Validation and Error Handling**
  The interface includes basic validation to prevent submission of incomplete or incorrect data, enhancing the overall user experience and ensuring reliable predictions.

2.2 Key Features

- **Machine Learning Integration**- The system uses a trained regression model to predict home prices based on real-world housing data.
- **Location-Sensitive Output**- The model accounts for variations in property prices across different geographical locations for higher accuracy.
- **Scalable and Secure Architecture**- The application is designed to support future feature additions while ensuring secure handling of user data.
- **User-Centric Design**- A simple, responsive, and intuitive user interface ensures accessibility and ease of use across all devices.

3. METHODOLOGY

The home price prediction system involves several stages as shown in Figure 1:

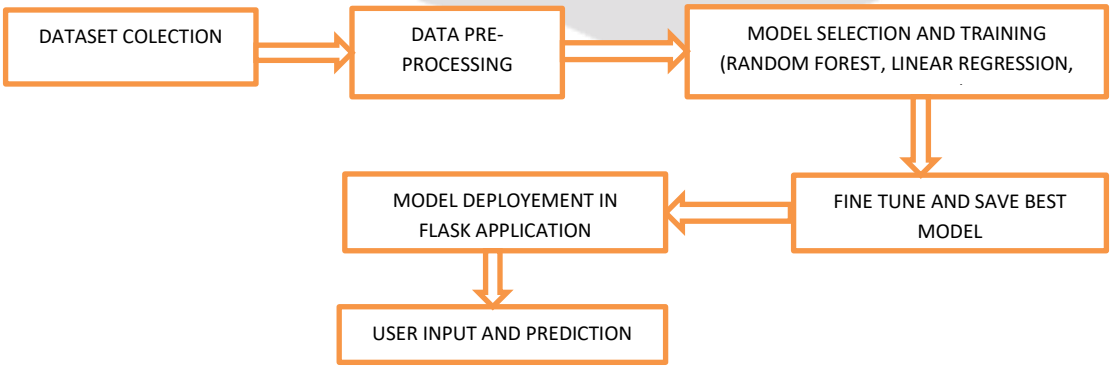

Fig -1: Methodology of Home Price Prediction Working system

The Home Price Prediction System follows a systematic machine learning development lifecycle, involving the following key stages:

1. **Data Collection**
   The dataset used for training the model is sourced from reliable real estate databases. It includes essential features such as location, total square footage, number of bedrooms (BHK), number of bathrooms, and price.
2. **Data Preprocessing**
   Raw data is cleaned and transformed to ensure model readiness. This includes handling missing values, encoding categorical variables (like location), removing outliers, and standardizing numerical values to improve model performance.
3. **Feature Selection**
   Based on correlation analysis and domain knowledge, the most influential features affecting home prices are selected to train the model. These typically include location, square footage, BHK, and bathrooms.
4. **Model Training**
   Machine learning algorithms such as Linear Regression, Random Forest, or Gradient Boosting are trained on the processed dataset. The model learns the relationship between the input features and the target variable (home price).
5. **Testing and Optimization**
   The application is tested under different conditions to ensure consistent and accurate performance. Based on test feedback, the model and user interface are optimized for better accuracy and usability.

4. PROPOSED SYSTEM

The proposed Home Price Prediction System aims to provide users with a smart, accurate, and accessible solution to estimate property prices based on real-time input.

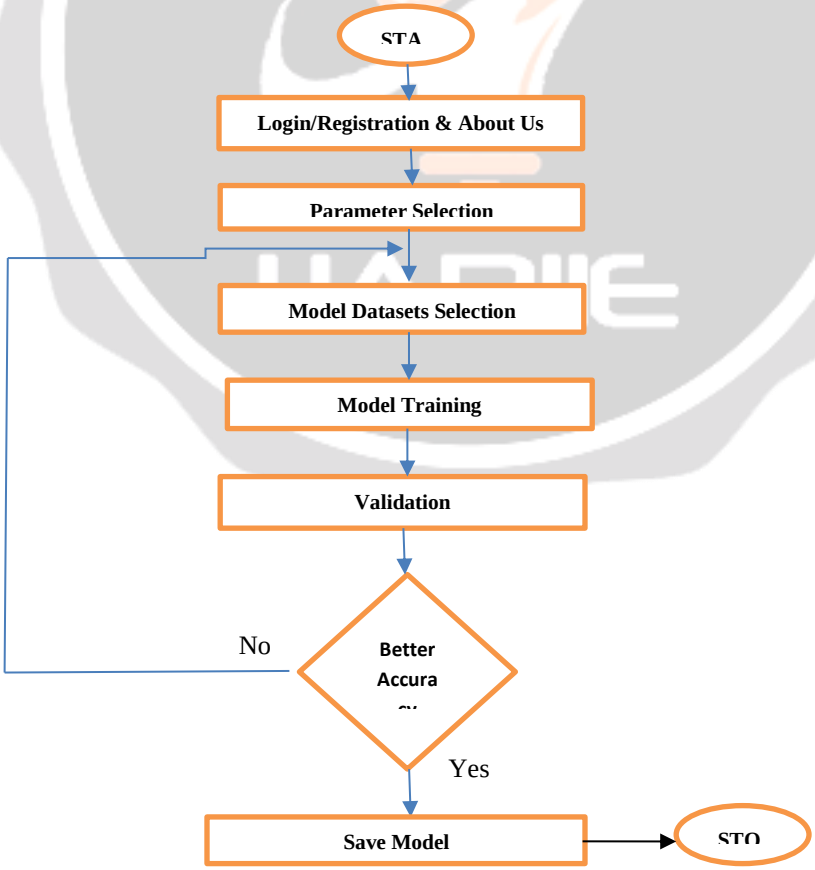

Fig -2: Workflow of Home Price Prediction System

4.1 System Architecture Overview

The system architecture follows a modular design, as shown in Figure 4.1. Users begin by selecting input features such as square footage, number of bedrooms (BHK), bathrooms, and location through a web-based interface**.**

- For each input, the system constructs a feature vector using one-hot encoding and passes it to a **pre-trained machine learning model** to estimate the property price.
- The **Flask web framework** handles user interactions and dynamically renders the prediction result back to the interface based on the model output**.**

5. CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

This project presents a simple yet practical approach to predicting home prices in Bangalore using machine learning. By collecting basic inputs like location, square footage, number of bedrooms, and bathrooms, the system gives users an estimated property price through a clean and interactive web interface. While the current system works well, there's still room for improvement. In the future, we plan to add more features such as property age, type (villa, apartment), and distance from key landmarks to make the predictions more accurate. Trying out more advanced models like deep learning could also boost performance. Expanding the system to support other cities is another goal we hope to work on.

6. REFERENCES

[1] **Li, C.** (2024). *House price prediction using machine learning*. *Applied and Computational Engineering*, 53, 225–237. https://doi.org/10.54254/2755-2721/53/20241426.

[2]**Chuhan, N.** (2024). *House price prediction based on different models of machine learning*. *Applied and Computational Engineering*, 49, 47–57. https://doi.org/10.54254/2755-2721/49/20241058.

[3]**Zhang, H.** (2024). *Predicting Housing Prices Using Supervised Machine Learning Models*. *Advances in Economics, Management and Political Sciences*, 118, 1–7. https://doi.org/10.54254/2754-1169/118/20242043.

[4] **Wang, Y., & Zhao, Q.** (2022). *House Price Prediction Based on Machine Learning: A Case of King County*. *(ICFIED 2022)*, 1547–1555. https://doi.org/10.2991/aebmr.k.220307.253.

[5] **Fang, L.** (2023). *Machine learning models for house price prediction*. *Applied and Computational Engineering*, 4, 409–415. https://doi.org/10.54254/2755-2721/4/20230505.

[6]**Pathak, S. M., & Chaudhari, A. K.** (2021). *Comparison of Machine Learning Algorithms for House Price* https://www.ijert.org/comparison-of-machine-learning-algorithms-for-house-price-prediction-using-real-time-data.

[7] **Ja'afar, N. S., Mohamad, J., & Ismail, S.** (2021). *Machine Learning for Property Price Prediction and Price Valuation: A Systematic Literature Review*. *Planning Malaysia*, 19(17). https://doi.org/10.21837/pm.v19i17.1018.

[8]**Kamal, N., Chaturvedi, E., Gautam, S., & Bhalla, S.** (2021). *House Price Prediction Using Machine Learning*. In *Emerging Technologies in Data Mining and Information Security* (pp. 813–822). Springer. https://doi.org/10.1007/978-981-15-9774-9_73.

[9] **Chowhaan, M. J., Nitish, D., Akash, G., Sreevidya, N., & Shaik, S.** (2023). *Machine Learning Approach for House Price Prediction*. *Asian Journal of Research in Computer Science*, 16(2), 54–61. https://doi.org/10.9734/ajrcos/2023/v16i2339.

[10]**Yazdani, M.** (2021). *Machine Learning, Deep Learning, and Hedonic Methods for Real Estate Price Prediction*. *arXiv preprint arXiv:2110.07151*. https://arxiv.org/abs/2110.07151.