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Web-based Fractional Ownership in Real Estate

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Abstract: ***The Indian real estate sector is one of the fastest-growing sectors. Real estate crowdfunding is a way of raising money for real estate investment by reaching out to a pool of investors to contribute a small amount of money towards a project. Real estate crowdfunding can be achieved by fractional ownership. Fractional ownership splits the cost of expensive property among several people. As popular the concepts seem, it has not been implemented in some parts concerning the higher risk factor. Such a process is complex if the person is a beginner and has little idea about the same. The objective of this paper is to display the real estate properties and connect investors-owners using a web-based application system. This system also advises market patterns, value ranges, and enhancing the advancements of the future cost will be predicted through machine learning model.***
Keywords: Fractional ownership, real estate, crowd funding, real estate price, prediction, web technology, Node.js application, React js application, machine learning

I. INTRODUCTION

Real estate has long been considered a sound investment, and for good reason. Before 2007, historical housing data made it seem like the price could continue to climb indefinitely. Real estate can enhance the risk and return profile of an investor's portfolio. The real estate market is one of low volatility, compared to cryptocurrency, equities, and bonds. Typically, this system offers Grade-A commercial property, which already has a tenant, for investments on the platform. Firstly, tenants or real estate companies must register in the system and provide valid details of the properties. After verification, properties will be listed on the portal. To invest in the property, users must have to submit documents and provide valid KYC documents. Then, an investor can apply to any property which is convenient to them, the portal will connect investors to the tenants. This system only displays and analyses the real estate market. However, legal transaction work will be proceeded by SPV. For any specific property, a Special Purpose Vehicle (SPV) is called, and the investment amount will be collected through a trusteeship company within which the SPV operates. The SPV purchases the property. Each fractional owner is a shareholder in the SPV proportionate to their contribution to the property. Some users buy the property and then sell it to fractional owners, others pool the money from investors and purchase the property. In both cases, ownership is transferred via SPV. The SPV's work is to hold the property on behalf of the customers. No other operational activities are carried out by it. Investors must sign the SPV agreements. This system will assume the responsibilities of the SPV. This system is implemented using HTML, CSS, React.js, material UI. For backend support, Node.js is used with MongoDB that is the non-relation database. The machine learning model is implemented using the python programming language. For the composition of the predictive model, linear regression is used with the Scikit-learn machine learning library. We try three algorithms which are linear regression, lasso, and decision tree. However, this research shows that Linear regression gives an accuracy of 84.77%. Moreover, Grid Search CV helps to find the best value in the linear regression. After the model is ready, it is integrated with the user interface using the Flask server.

II. METHODOLOGY

A. Admin Module

1) Admin module plays an important role. Admin login into the system.
2) Admin can add or remove the property from the system.
3) Admin can grant the privileges to owners to modify owner's property.
4) Admin can remove the users and discard all the access rights.

B. Owner Module

1) The owner must have to submit the documents.
2) The owner can view their property details.
3) The owner can request to add a new property. Also, modify the details of the property.

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4) The owner can get details of investors of their property. The owner must sign up and login into the owner's portal. Firstly, the owner must sign the digital contract with the system as well as with SPV. Now, the owner will request the admin to grant privileges to upload property details on the portal. After approval, the owner can add property name, description, tenant details, return of investment, square feet area, type of build-up, number of investors needed, funding details, minimum investment amount, lock-in period, and other necessary property details. Moreover, the owner can request for modification of property details.

C. Investor Module

1) An investor must sign up and login into the investors' portal.
2) An investor can view all the listed properties.
3) An investor can analyse the property based on graphs also.
4) Interested Investors must have to follow the steps to invest in the property. First and foremost, the investor must enter the amount which he wants to invest, as per the amount, the calculated percentage will be displayed on the screen. In the next step, a portal will schedule a meeting with the investor and owner of the property. After the confirmation from the owner, the further process will take care of by SPV. SPV will further confirm the procedure of legalization. In the end, the investor can visit the dashboard and manage the property details.

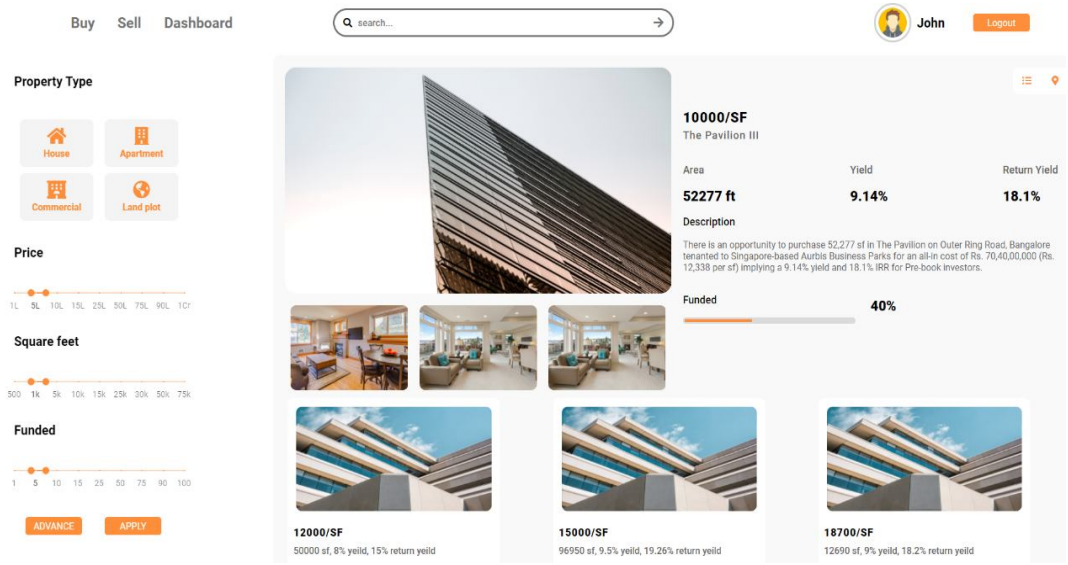


Figure 1: Homepage of website

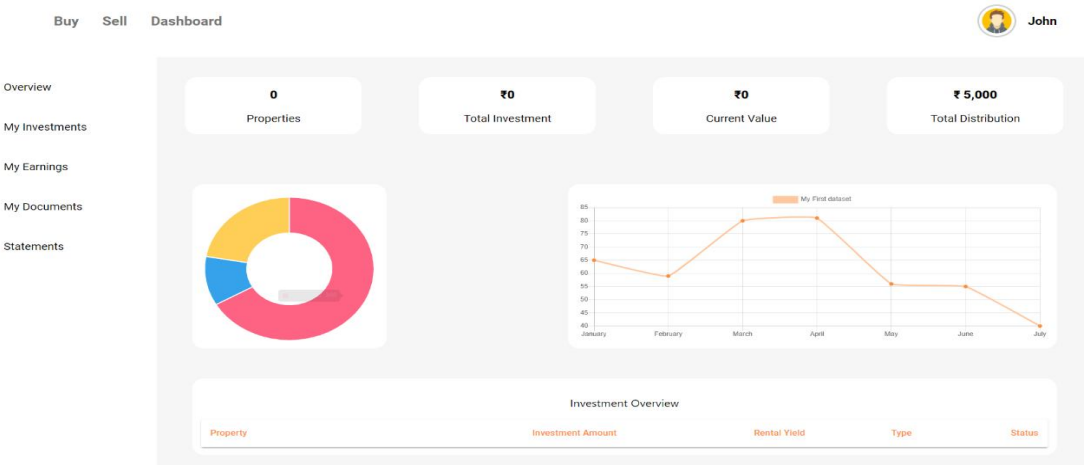


Figure 2: Dashboard of Investor

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D. Sell Module

Sell Module is specifically for fractional owners who have already invested in property. However, the lock-in periods are decided by tenants. After completing the lock-in period, one can sell the owned property. The fractional owner can request the admin to sell the property. Admin will handle the procedure with SPV for legal documentations.

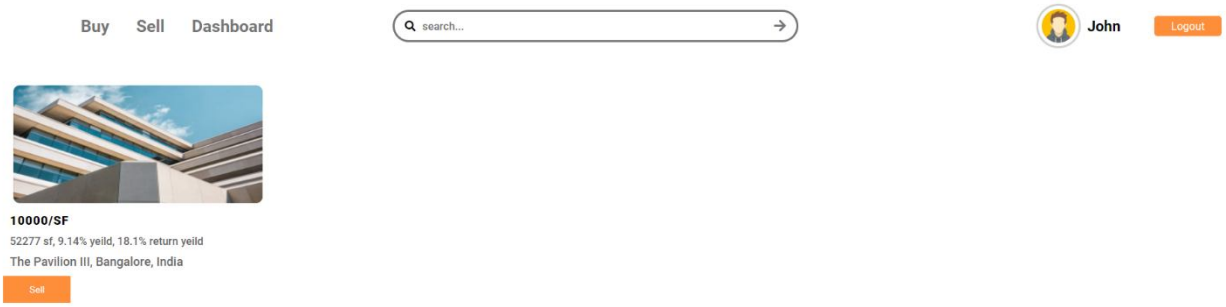


Figure 3: Sell module

III.MODELING AND ANALYSIS

Machine learning is striking feature of this system. For convenience, we have taken Bangalore city dataset for our system. Then, we follow certain steps to achieve result of the system.

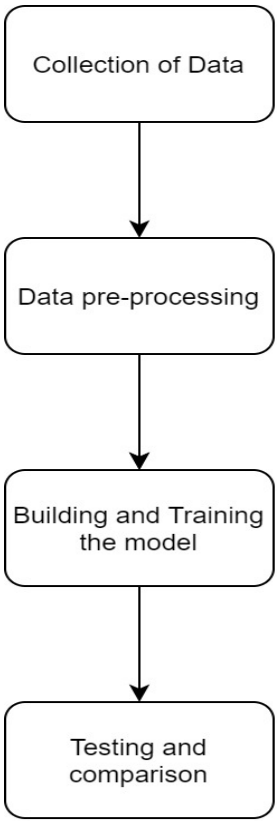


Figure 4: Data Process flow chart

A. Collection of Data

Data is the heart of machine learning. Predictive models use data for training which gives somewhat accurate results. Without data we can't train the model. Machine learning involves building these models from data and uses them to predict new data. Machine Learning is a subset of Artificial Intelligence. It gives system capability to learn wherein it automatically learns and improves its performance without being explicitly programmed. The dataset used here is taken from Kaggle.

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B. Data Pre-processing

Data pre-processing is the process of cleaning our data set. There might be missing values in the dataset, or the values of the features can be oddly distributed. These can be handled by data cleaning. If there are missing values in a variable, we will drop those values or substitute it with the average value and if the number of missing values is big then we have to drop that variable from our dataset. Some of the columns such as society, area type, balconies and availability were dropped of the dataset as society column has a lot of missing values and the others have not an important part in predicting the house price. A new feature was engineered, and outliers were removed by using different methods. One Hot Encoding was used for categorical data.

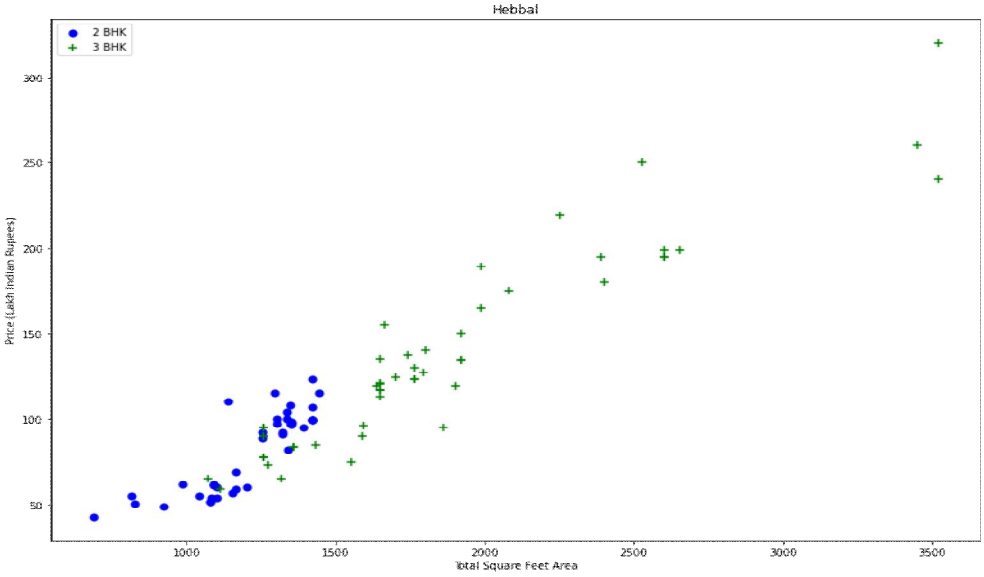


Figure 5: Hebbal area BHK details before data cleaning

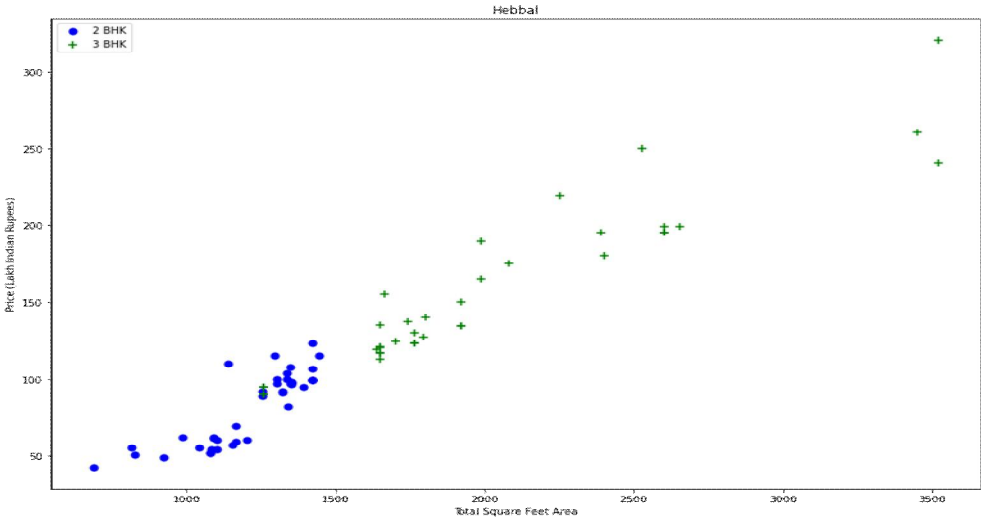


Figure 6: Hebbal area BHK details after data cleaning

C. Building and training the model

The dataset was split into training and testing set with 80% in training set and remaining 20% data in test set.

```
In [57]:
1 from sklearn.model_selection import train_test_split
2 X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.2,random_state=10)
```

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D. Testing and Comparison

Testing was done using K-Fold Cross-Validation. Root Mean Square Error is used for comparing the models.

Use Liner Regression algorithm for model training

```
In [58]:
from sklearn.linear_model import LinearRegression
lr_clf = LinearRegression()
lr_clf.fit(X_train,y_train)
lr_clf.score(X_test,y_test)

Out[58]: 0.8629136373780912
```

```
In [59]:
from sklearn.model_selection import ShuffleSplit
from sklearn.model_selection import cross_val_score

cv = ShuffleSplit(n_splits=5, test_size=0.2, random_state=0)

cross_val_score(LinearRegression(), X, y, cv=cv)

Out[59]: array([0.8270256 , 0.86027025, 0.85322143, 0.84364659, 0.85481486])
```

IV. RESULTS AND DISCUSSION

The web- based portal integrated with Machine Learning. Here, a user signs up and logs in into their respective profile. As shown from the landing page, user can choose either option. After logging in, the user may select any of the properties or can customized properties using the filters. Once selected, user will be able to see the predicted returns for the property. The user can schedule call and view the tenant details from the same. The user is free to hold or sell his part in the property. React, Nodejs, MongoDB have been used for implementing. For the Machine Learning, we have used a dataset of 13k rows and 9+ columns, data cleaning, transformation and handling has been performed using python. All major attributes have been added for accurate analysis. We have also made use of Grid Search CV algorithm to check accuracy of various potential algorithms used for our project. Linear Regression showed the highest- 84.77% accuracy.

Table 1: Accuracy of three different algorithms on dataset

Model	Best Score	Best Parameters
Linear_regression	0.847796 = 84.7796%	{‘normalize’:False}
Lasso	0.728440 = 72.8440%	{‘alpha’:1,’selection’:’random’}
Decision_tree	0.724849 = 72.4849%	{‘criterion’:’friedman_mse’, ’splitter’:’random’}

```
In [63]: predict_price('Rajaji Nagar',6232, 4, 4)
Out[63]: array([649.38760639, 681.85688959, 709.13172976, 723.31382842])

In [64]: predict_price('Shivaji Nagar',5182, 5, 4)
Out[64]: array([424.03966942, 445.24272092, 463.04990473, 472.31433383])

In [65]: predict_price('Whitefield',10797,5,5)
Out[65]: array([845.28623055, 887.55056806, 923.05270762, 941.51272836])

In [66]: predict_price('1st Phase JP Nagar',2875, 4, 4)
Out[66]: array([238.51661162, 250.44267071, 260.45981593, 265.66898661])
```

V. CONCLUSION

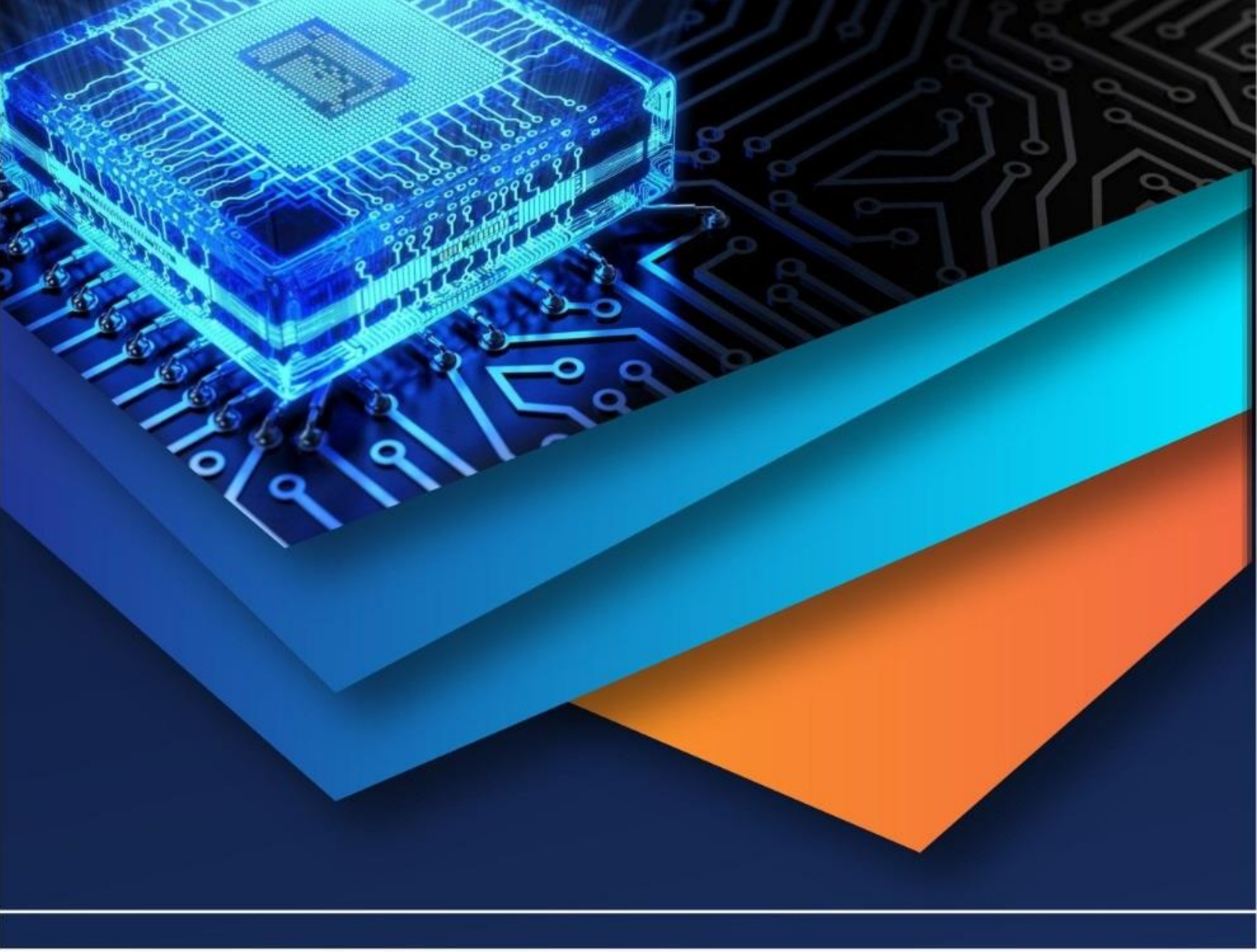
Our platform provides a simple yet efficient way to invest in real estate commercial properties within few clicks. The portal is simple to use for a layman in the field of investing and provides proper prediction to estimate the returns on a property. It also ensures that the tenant and the property details are valid. The additional features ensure user’s convenience and comfort. Using a dataset covering wide areas; we have tried to ensure that the return predicts are as realistic and in less margin to the actual numbers.

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