In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
# pd.set_option('display.max_rows',None)
```

In [2]:

```
raw_df=pd.read_csv("datasets//bengaluru_house_prices.csv")
```

In [3]:

```
raw_df
```

Out[3]:

	area_type	availability	location	size	society	total_sqft	bath	balcony	
0	Super built-up Area	19-Dec	Electronic City Phase II	2 BHK	Coomee	1056	2.0	1.0	
1	Plot Area	Ready To Move	Chikka Tirupathi	4 Bedroom	Theanmp	2600	5.0	3.0	1
2	Built-up Area	Ready To Move	Uttarahalli	3 BHK	NaN	1440	2.0	3.0	
3	Super built-up Area	Ready To Move	Lingadheeranahalli	3 BHK	Soiewre	1521	3.0	1.0	
4	Super built-up Area	Ready To Move	Kothanur	2 BHK	NaN	1200	2.0	1.0	
...	...	...	...	...	...	...	...	...	
13315	Built-up Area	Ready To Move	Whitefield	5 Bedroom	ArsiaEx	3453	4.0	0.0	2
13316	Super built-up Area	Ready To Move	Richards Town	4 BHK	NaN	3600	5.0	NaN	4
13317	Built-up Area	Ready To Move	Raja Rajeshwari Nagar	2 BHK	Mahla T	1141	2.0	1.0	
13318	Super built-up Area	18-Jun	Padmanabhanagar	4 BHK	SollyCl	4689	4.0	1.0	4
13319	Super built-up Area	Ready To Move	Doddathoguru	1 BHK	NaN	550	1.0	1.0	

13320 rows × 9 columns

DataCleaning

In [4]:

```
raw_df.shape
```

Out[4]:

```
(13320, 9)
```

In [5]:

```
# raw_df.groupby('area_type')['area_type'].agg('count')
```

In [6]:

```
raw_df.groupby('area_type',group_keys=True).apply(lambda x:len(x))
```

Out[6]:
```
area_type
Built-up  Area          2418
Carpet  Area              87
Plot  Area              2025
Super built-up  Area    8790
dtype: int64
```

In [7]:
```
# raw_df.groupby('location').apply(lambda x:x)
```

In [8]:
```
raw_df.columns
```

Out[8]:
```
Index(['area_type', 'availability', 'location', 'size', 'society',
       'total_sqft', 'bath', 'balcony', 'price'],
      dtype='object')
```

In [9]:
```
l=['society','area_type','availability']
```

In [10]:
```
# raw_df.drop(l,axis='columns',inplace=True)
# raw_df
```

In [11]:
```
df=raw_df.drop(l,axis='columns')
```

In [12]:
```
df
```

Out[12]:

	location	size	total_sqft	bath	balcony	price
0	Electronic City Phase II	2 BHK	1056	2.0	1.0	39.07
1	Chikka Tirupathi	4 Bedroom	2600	5.0	3.0	120.00
2	Uttarahalli	3 BHK	1440	2.0	3.0	62.00
3	Lingadheeranahalli	3 BHK	1521	3.0	1.0	95.00
4	Kothanur	2 BHK	1200	2.0	1.0	51.00
...	...	...	...	...	...	...
13315	Whitefield	5 Bedroom	3453	4.0	0.0	231.00
13316	Richards Town	4 BHK	3600	5.0	NaN	400.00
13317	Raja Rajeshwari Nagar	2 BHK	1141	2.0	1.0	60.00
13318	Padmanabhanagar	4 BHK	4689	4.0	1.0	488.00
13319	Doddathoguru	1 BHK	550	1.0	1.0	17.00

13320 rows × 6 columns

In [13]:
```
df.isnull().sum()
```

Out[13]:
```
location        1
size           16
total_sqft      0
bath           73
balcony       609
price           0
dtype: int64
```

In [14]:
```
df.dropna(inplace=True)
```

In [15]:
```
df.shape
```

Out[15]:
```
(12710, 6)
```

In [16]:
```
df.head()
```

Out[16]:

	location	size	total_sqft	bath	balcony	price
0	Electronic City Phase II	2 BHK	1056	2.0	1.0	39.07
1	Chikka Tirupathi	4 Bedroom	2600	5.0	3.0	120.00
2	Uttarahalli	3 BHK	1440	2.0	3.0	62.00
3	Lingadheeranahalli	3 BHK	1521	3.0	1.0	95.00
4	Kothanur	2 BHK	1200	2.0	1.0	51.00

In [17]:
```
df['size'].unique()
```

Out[17]:
```
array(['2 BHK', '4 Bedroom', '3 BHK', '3 Bedroom', '1 BHK', '1 RK',
       '4 BHK', '1 Bedroom', '2 Bedroom', '6 Bedroom', '8 Bedroom',
       '7 Bedroom', '5 BHK', '7 BHK', '6 BHK', '5 Bedroom', '11 BHK',
       '9 BHK', '9 Bedroom', '27 BHK', '11 Bedroom', '43 Bedroom',
       '14 BHK', '8 BHK', '12 Bedroom', '10 Bedroom', '13 BHK'],
      dtype=object)
```

In [18]:
```
df['size']=df['size'].apply(lambda x:int(x.split()[0]))
```

In [19]:
```
df.head(3)
```

Out[19]:

	location	size	total_sqft	bath	balcony	price
0	Electronic City Phase II	2	1056	2.0	1.0	39.07
1	Chikka Tirupathi	4	2600	5.0	3.0	120.00
2	Uttarahalli	3	1440	2.0	3.0	62.00

In [20]:
```
df['bath'].unique()
```

Out[20]:
```
array([ 2.,  5.,  3.,  4.,  1.,  8.,  7.,  6.,  9., 27., 11., 12., 10.,
       40., 15., 13.])
```

In [21]:
```
def is_float(n):
    try:float(n)
    except:return False
    return True
```

In [22]:
```
# is_float(5)
```

In [ ]:
```

```

In [23]:
```
df[df['total_sqft'].apply(is_float)==False].head(10)
```

Out[23]:

	location	size	total_sqft	bath	balcony	price
30	Yelahanka	4	2100 - 2850	4.0	0.0	186.000
122	Hebbal	4	3067 - 8156	4.0	0.0	477.000
137	8th Phase JP Nagar	2	1042 - 1105	2.0	0.0	54.005
165	Sarjapur	2	1145 - 1340	2.0	0.0	43.490
188	KR Puram	2	1015 - 1540	2.0	0.0	56.800
410	Kengeri	1	34.46Sq. Meter	1.0	0.0	18.500
549	Hennur Road	2	1195 - 1440	2.0	0.0	63.770
661	Yelahanka	2	1120 - 1145	2.0	0.0	48.130
672	Bettahalsoor	4	3090 - 5002	4.0	0.0	445.000
772	Banashankari Stage VI	2	1160 - 1195	2.0	0.0	59.935

In [ ]:

In [24]:

```
def convert_range_to_num(a):
    tokens=a.split('-')
    if len(tokens)==2:
        return (float(tokens[0])+float(tokens[1]))//2
    try:
        return float(a)
    except:
        return None
```

In [25]:

```
# convert_range_to_num('100-100')
```

In [26]:

```
df.total_sqft=df['total_sqft'].apply(convert_range_to_num)
```

In [27]:

```
df.dropna(inplace=True)
```

In [28]:

```
df[df['total_sqft'].apply(is_float)==False].head(10)
```

Out[28]:

location	size	total_sqft	bath	balcony	price

Feature Engineering

In [29]:

```
df['price_per_sqft']=df['price']*100000/df['total_sqft']
```

In [30]:

```
df.head()
```

Out[30]:

	location	size	total_sqft	bath	balcony	price	price_per_sqft
0	Electronic City Phase II	2	1056.0	2.0	1.0	39.07	3699.810606
1	Chikka Tirupathi	4	2600.0	5.0	3.0	120.00	4615.384615
2	Uttarahalli	3	1440.0	2.0	3.0	62.00	4305.555556
3	Lingadheeranahalli	3	1521.0	3.0	1.0	95.00	6245.890861
4	Kothanur	2	1200.0	2.0	1.0	51.00	4250.000000

In [31]:

```
len(df.location.unique())
```

Out[31]:
```
1259
```

In [32]:
```
df.location=df.location.apply(lambda x:x.strip())
```

In [33]:
```
location_stats=df.groupby('location',group_keys=True).apply(lambda x:len(x)
```

In [34]:
```
location_stats
```

Out[34]:
```
location
Whitefield              514
Sarjapur  Road          372
Electronic City         302
Kanakpura Road          259
Thanisandra             233
                       ...
1 Giri Nagar              1
Kanakapura  Rod           1
Kanakapura Main Road      1
Kanakapura Road           1
whitefiled                1
Length: 1248, dtype: int64
```

In [35]:
```
len(location_stats[location_stats<=10])
```

Out[35]:
```
1013
```

In [36]:
```
location_stats_lessthan10=location_stats[location_stats<=10]
```

In [37]:
```
df.location=df.location.apply(lambda x:'other' if x in location_stats_lessth
```

In [38]:
```
len(df.location.unique())
```

Out[38]:
```
236
```

RemovalOfOutliers

Techniques we can use

standard deviation domain knowledge

In [39]:
```
len(df)
df.isna().sum()
```

Out[39]:
```
location          0
size              0
total_sqft        0
bath              0
balcony           0
price             0
price_per_sqft    0
dtype: int64
```

In [40]:
```
df[(df.total_sqft/df.size)<300].head()
```

Out[40]:

	location	size	total_sqft	bath	balcony	price	price_per_sqft
0	Electronic City Phase II	2	1056.0	2.0	1.0	39.07	3699.810606
1	Chikka Tirupathi	4	2600.0	5.0	3.0	120.00	4615.384615
2	Uttarahalli	3	1440.0	2.0	3.0	62.00	4305.555556
3	Lingadheeranahalli	3	1521.0	3.0	1.0	95.00	6245.890861
4	Kothanur	2	1200.0	2.0	1.0	51.00	4250.000000

In [41]:
```
len(df[df.total_sqft/df.size<300])
```

Out[41]:
```
12668
```

In [42]:
```
len(df[df.total_sqft/df.size>300])
```

Out[42]:
```
0
```

In [43]:
```
df.shape
```

Out[43]:
```
(12668, 7)
```

In [44]:
```
buffer_df=df.copy()
```

In [45]:
```
buffer_df=buffer_df[~(buffer_df.total_sqft/buffer_df.size>300)]
```

In [46]:
```
buffer_df.shape
```

Out[46]:
```
(12668, 7)
```

OUTLIER REMOVAL USING STANDARD DEVIATION AND MEAN

In [47]:
```
df
```

Out[47]:

	location	size	total_sqft	bath	balcony	price	price_per_sqft
0	Electronic City Phase II	2	1056.0	2.0	1.0	39.07	3699.810606
1	Chikka Tirupathi	4	2600.0	5.0	3.0	120.00	4615.384615
2	Uttarahalli	3	1440.0	2.0	3.0	62.00	4305.555556
3	Lingadheeranahalli	3	1521.0	3.0	1.0	95.00	6245.890861
4	Kothanur	2	1200.0	2.0	1.0	51.00	4250.000000
...	...	...	...	...	...	...	...
13314	Green Glen Layout	3	1715.0	3.0	3.0	112.00	6530.612245
13315	Whitefield	5	3453.0	4.0	0.0	231.00	6689.834926
13317	Raja Rajeshwari Nagar	2	1141.0	2.0	1.0	60.00	5258.545136
13318	Padmanabhanagar	4	4689.0	4.0	1.0	488.00	10407.336319
13319	Doddathoguru	1	550.0	1.0	1.0	17.00	3090.909091

12668 rows × 7 columns

In [48]:
```
df.price_per_sqft.describe()
```

Out[48]:

```
count    1.266800e+04
mean     6.876288e+03
std      2.263354e+04
min      2.678298e+02
25%      4.242721e+03
50%      5.376344e+03
75%      7.142857e+03
max      2.300000e+06
Name: price_per_sqft, dtype: float64
```

Here we find that min price per sqft is 267 rs/sqft whereas max is 12000000, this shows a wide variation in property prices. We should remove outliers per location using mean and one standard deviation

Outliers

In [49]:

```
# def apply_outlier_method(col):
# least,highest=remove_outlier(df['location'])
# df['location']=np.where(df['location']>highest,highest,df['location'])
# df['location']=np.where(df['location']<least,least,df['location'])


# def remove_outlier(col):
#     sorted(col)
#     q1=col.quantile(0.25)
#     q3=col.quantile(0.75)
#     iqr=q3-q1
#     lowerRange=q1-(1.5*iqr)
#     higherRange=q3+(1.5*iqr)
#     return lowerRange,higherRange
```

In [50]:

```
buffer_df=df.copy()
```

In [51]:

```
def remove_pps_outliers(df):
    df_out = pd.DataFrame()
    for key, subdf in df.groupby('location'):
        m = np.mean(subdf.price_per_sqft)
        st = np.std(subdf.price_per_sqft)
        reduced_df = subdf[(subdf.price_per_sqft>(m-st)) & (subdf.price_per_
        df_out = pd.concat([df_out,reduced_df],ignore_index=True)
    return df_out


buffer_df = remove_pps_outliers(buffer_df)
buffer_df.shape
```

Out[51]:

```
(10826, 7)
```

In [52]:

```
df=buffer_df.copy()
df.shape
```

Out[52]:

```
(10826, 7)
```

NOW WE ARE CHECKING FOR THE APARTMENTS OF 2BHK AND 3BHK WITH ALMOST SAME SQUARE FT AND BELONG TO SAME AREA->BUT HAVEPRICE OF 2BHK MORE THA N PRICE OF 3BHK

WE DONOT KNOW THE REASON OF THIS.

In [53]:

```
df.isna().sum()
```

Out[53]:

```
location         0
size             0
total_sqft       0
bath             0
balcony          0
price            0
price_per_sqft   0
dtype: int64
```

In [54]:

```
df
```

Out[54]:

	location	size	total_sqft	bath	balcony	price	price_per_sqft
0	1st Block Jayanagar	4	2850.0	4.0	1.0	428.00	15017.543860
1	1st Block Jayanagar	3	1630.0	3.0	2.0	194.00	11901.840491
2	1st Block Jayanagar	6	1200.0	6.0	2.0	125.00	10416.666667
3	1st Block Jayanagar	3	1875.0	2.0	3.0	235.00	12533.333333
4	1st Block Jayanagar	7	930.0	4.0	2.0	85.00	9139.784946
...	...	...	...	...	...	...	...
10821	other	2	1256.0	2.0	1.0	65.00	5175.159236
10822	other	2	1353.0	2.0	2.0	110.00	8130.081301
10823	other	1	812.0	1.0	0.0	26.00	3201.970443
10824	other	3	1440.0	2.0	2.0	63.93	4439.583333
10825	other	2	1075.0	2.0	2.0	48.00	4465.116279

10826 rows × 7 columns

RENAMING SIZE BECAUSE DF.SIZE IS RETURNING THE SIZE OF DF INSTEAD OF COLUMN SIZE

In [55]:

```
df.rename(columns={'size':'bhk'},inplace=True)
df
```

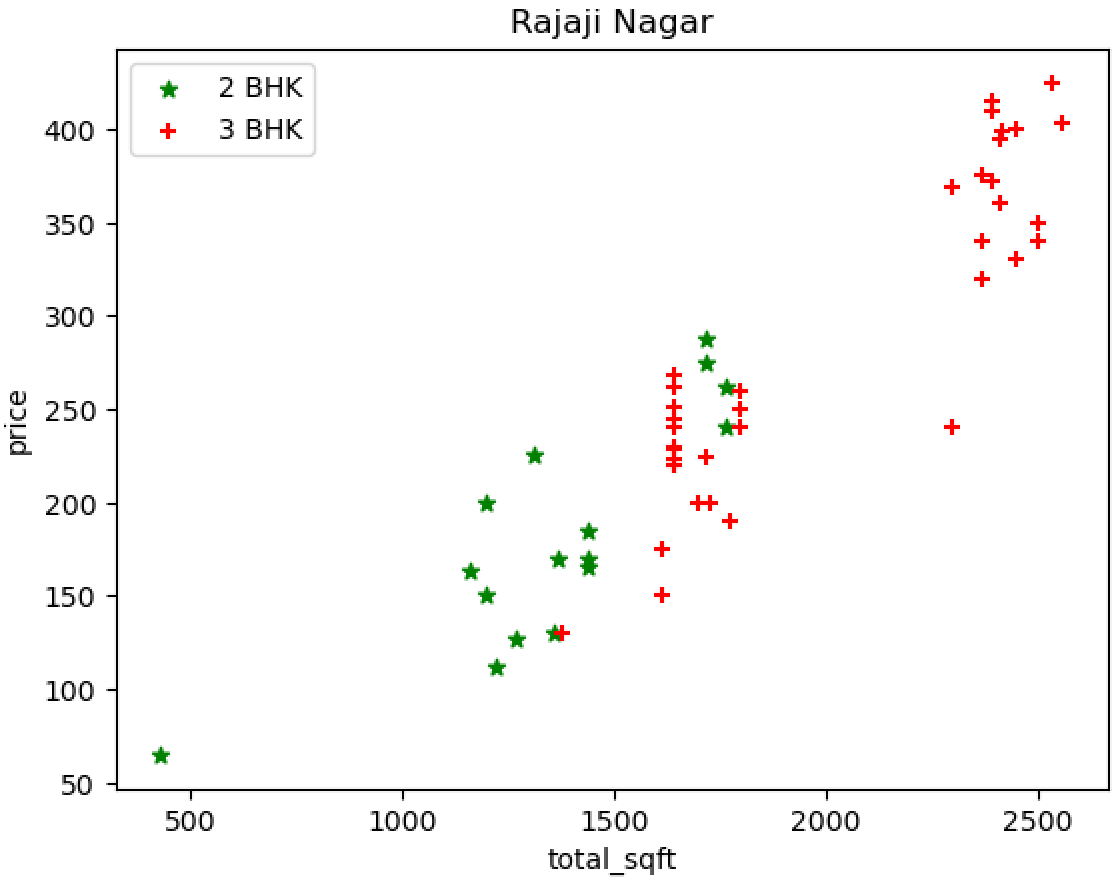
Out[55]:

	location	bhk	total_sqft	bath	balcony	price	price_per_sqft
0	1st Block Jayanagar	4	2850.0	4.0	1.0	428.00	15017.543860
1	1st Block Jayanagar	3	1630.0	3.0	2.0	194.00	11901.840491
2	1st Block Jayanagar	6	1200.0	6.0	2.0	125.00	10416.666667
3	1st Block Jayanagar	3	1875.0	2.0	3.0	235.00	12533.333333
4	1st Block Jayanagar	7	930.0	4.0	2.0	85.00	9139.784946
...	...	...	...	...	...	...	...
10821	other	2	1256.0	2.0	1.0	65.00	5175.159236
10822	other	2	1353.0	2.0	2.0	110.00	8130.081301
10823	other	1	812.0	1.0	0.0	26.00	3201.970443
10824	other	3	1440.0	2.0	2.0	63.93	4439.583333
10825	other	2	1075.0	2.0	2.0	48.00	4465.116279

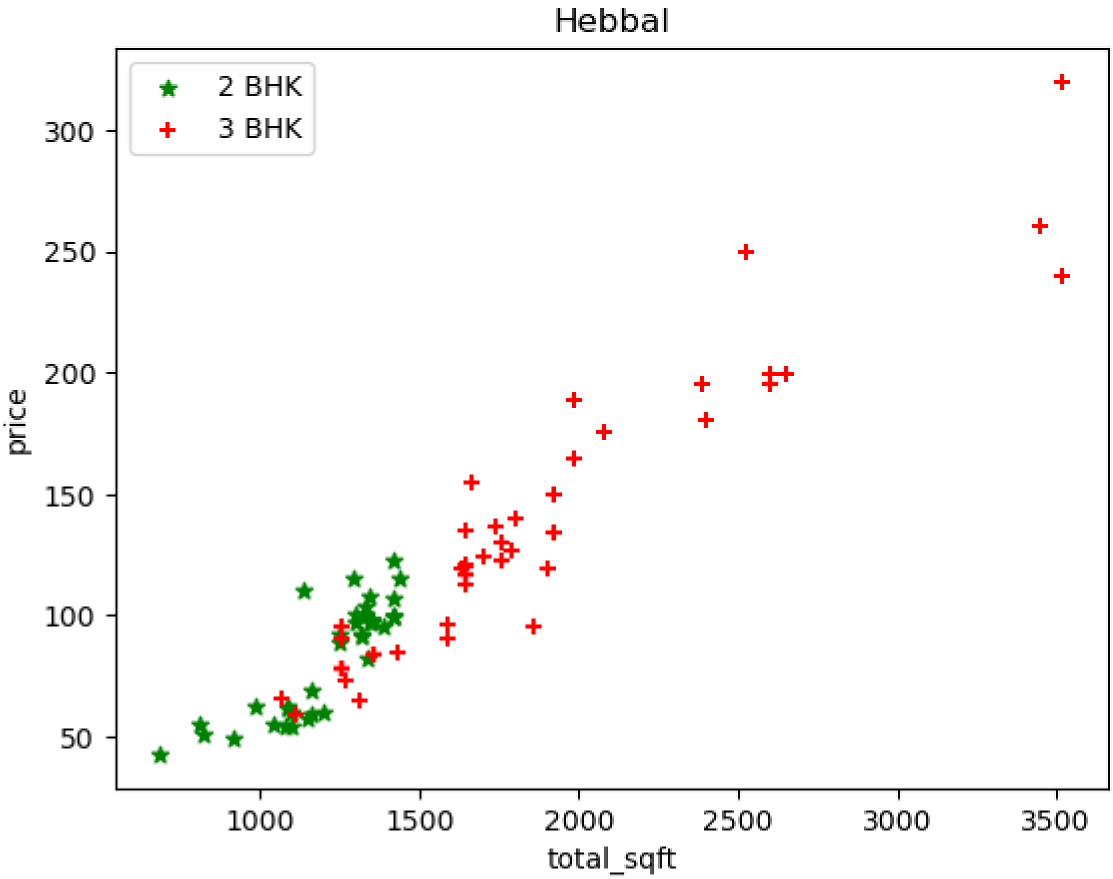
10826 rows × 7 columns

In [56]:
```
def plot_scatter_plot(df,loc):
#     print(df,loc)
#     print(df.size)
    bhk2=df[(df.location==loc) & (df.bhk==2)]
    bhk3=df[(df.location==loc) & (df.bhk==3)]
#     print(bhk2,bhk3)
#     plt.figure(figsize=(1,1))
    plt.scatter(bhk2.total_sqft,bhk2.price,color='green',marker='*',label='2
    plt.scatter(bhk3.total_sqft,bhk3.price,color='red',marker='+',label='3 B
    plt.xlabel("total_sqft")
    plt.ylabel("price")
    plt.title(loc)
    plt.legend()
```

In [57]:
```
plot_scatter_plot(df,"Rajaji Nagar")
```



In [58]:
```
plot_scatter_plot(df,"Hebbal")
```



WE CAN SEE THAT IN MANY CASES FOR THE SAME TOTAL_SQFT GREEN DOTS ARE AT HIGHER PRICE THATN RED DOTS WHICH MEANS 2BHK'S WERE COSTLIER THAT 3BHK'S FOR SAME SQFT WE HAVE TO REMOVE SUCH DATA INCONSITENCY WHICH WILL.MAY TROUBLE OUR MODEL WHIE TRAINING

NOW THE BELOW FUNCTION DEALS WITH THIS BY CREATING DATA OF MEAN,STD,COUNT OF 1,2,3.. BHK AND COMPARE THE PRICE WITH MEAN OF SMALLER BHK

In [59]:

```
def remove_bhk_outliers(df):
    exclude_indices=np.array([])
    for location,location_df in df.groupby('location'):
        bhk_stats={}
        for bhk,bhk_df in location_df.groupby('bhk'):
            bhk_stats[bhk]={
                'mean':np.mean(bhk_df.price_per_sqft),
                'std':np.std(bhk_df.price_per_sqft),
                'count':bhk_df.shape[0]
            }
            for bhk,bhk_df in location_df.groupby('bhk'):
                stats=bhk_stats.get(bhk-1)
                if stats and stats['count']>5:
                    exclude_indices=np.append(exclude_indices,bhk_df[bhk_df
    return df.drop(exclude_indices,axis='index')
```

In [60]:

```
buffer_df=remove_bhk_outliers(df)
```

In [61]:

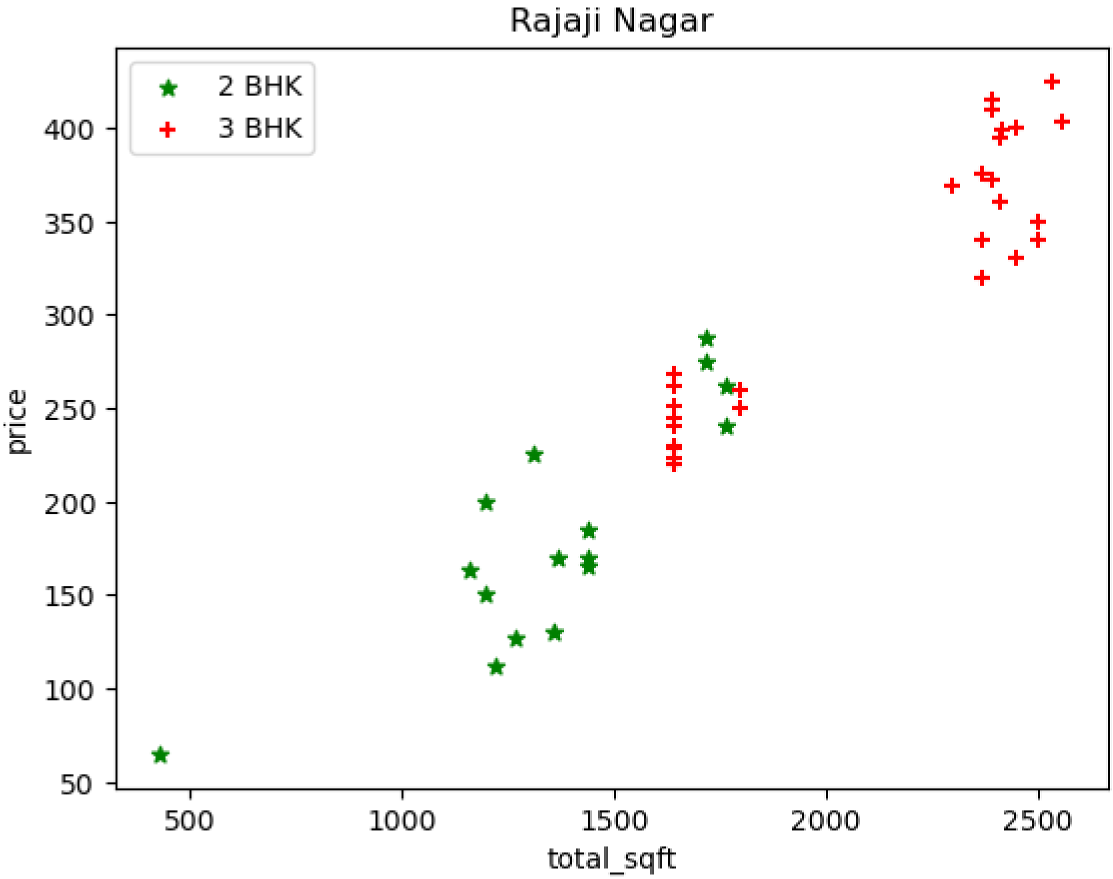
```
buffer_df.shape
```

Out[61]:

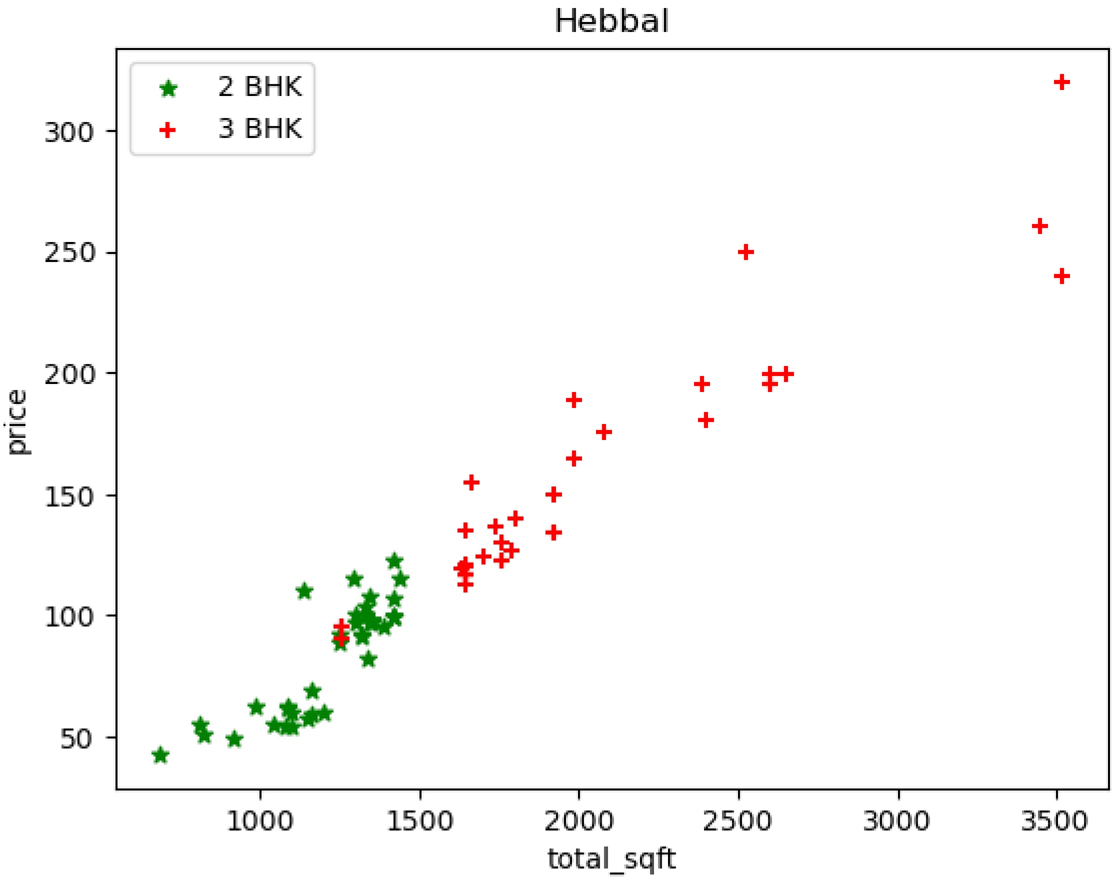
```
(7542, 7)
```

In [62]:
```
df=buffer_df.copy()
```

In [63]:
```
plot_scatter_plot(df,"Rajaji Nagar")
```



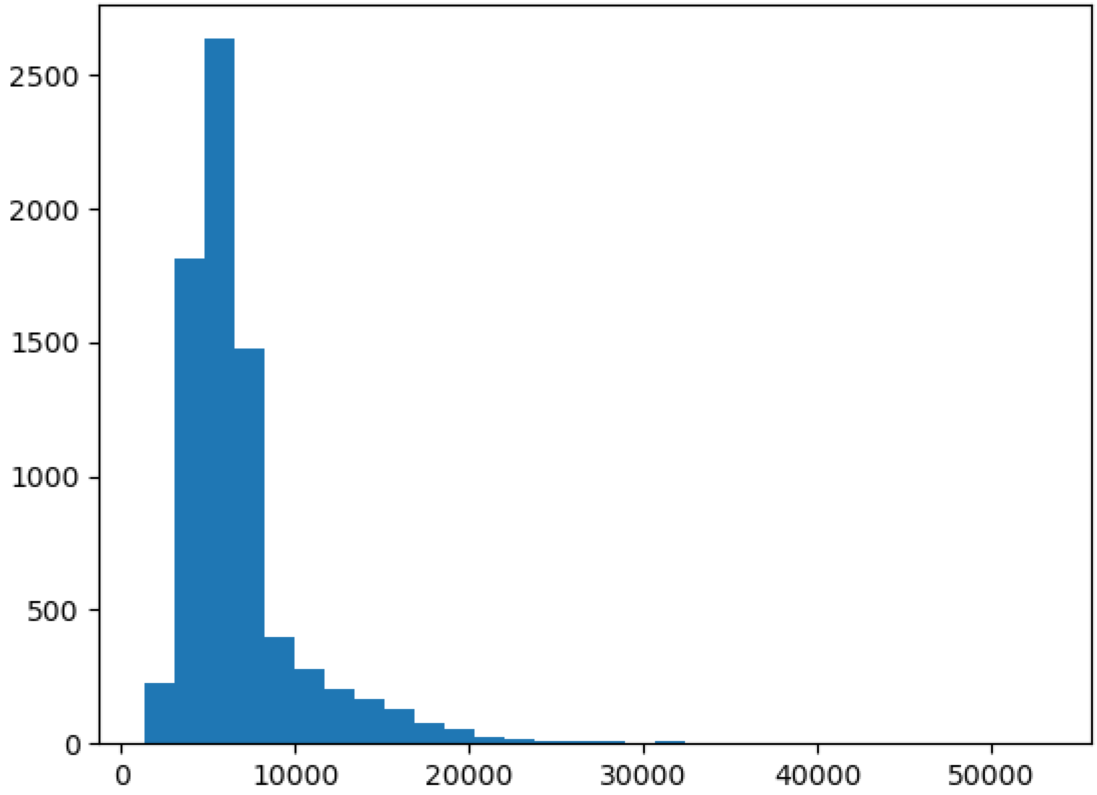
In [64]:
```
plot_scatter_plot(df,"Hebbal")
```



NOW CHECKING ABOUT THE PRICE DISTIBUTION WITH COUNT

```
In [65]: plt.hist(df.price_per_sqft,bins=30)
```

```
Out[65]: (array([2.250e+02, 1.815e+03, 2.632e+03, 1.473e+03, 3.960e+02, 2.790e+02,
                2.040e+02, 1.700e+02, 1.270e+02, 7.400e+01, 5.500e+01, 2.400e+01,
                1.800e+01, 1.300e+01, 1.100e+01, 7.000e+00, 4.000e+00, 7.000e+00,
                2.000e+00, 3.000e+00, 1.000e+00, 0.000e+00, 0.000e+00, 0.000e+00,
                0.000e+00, 0.000e+00, 1.000e+00, 0.000e+00, 0.000e+00, 1.000e+00]),
          array([ 1300.        ,  3028.33333333,  4756.66666667,  6485.        ,
                  8213.33333333,  9941.66666667, 11670.        , 13398.33333333,
                 15126.66666667, 16855.        , 18583.33333333, 20311.66666667,
                 22040.        , 23768.33333333, 25496.66666667, 27225.        ,
                 28953.33333333, 30681.66666667, 32410.        , 34138.33333333,
                 35866.66666667, 37595.        , 39323.33333333, 41051.66666667,
                 42780.        , 44508.33333333, 46236.66666667, 47965.        ,
                 49693.33333333, 51421.66666667, 53150.        ]),
          <BarContainer object of 30 artists>)
```



IT IS LIKE ALMOST A BELL CURVE WITH NORMAL DISTRIBUTION IT IS GOOD DATASET NOW.

EXPLORE BATHROOM FEATURE NOW

```
In [66]: df.bath.unique()
```

```
Out[66]: array([ 4.,  3.,  6.,  2.,  1.,  5.,  8.,  7.,  9., 10., 27., 11., 15.,
                13.])
```

```
In [67]: df[df.bath>10]
```

Out[67]:

	location	bhk	total_sqft	bath	balcony	price	price_per_sqft
8440	other	27	8000.0	27.0	0.0	230.0	2875.000000
8449	other	11	1200.0	11.0	0.0	170.0	14166.666667
9096	other	14	1250.0	15.0	0.0	125.0	10000.000000
10107	other	13	5425.0	13.0	0.0	275.0	5069.124424

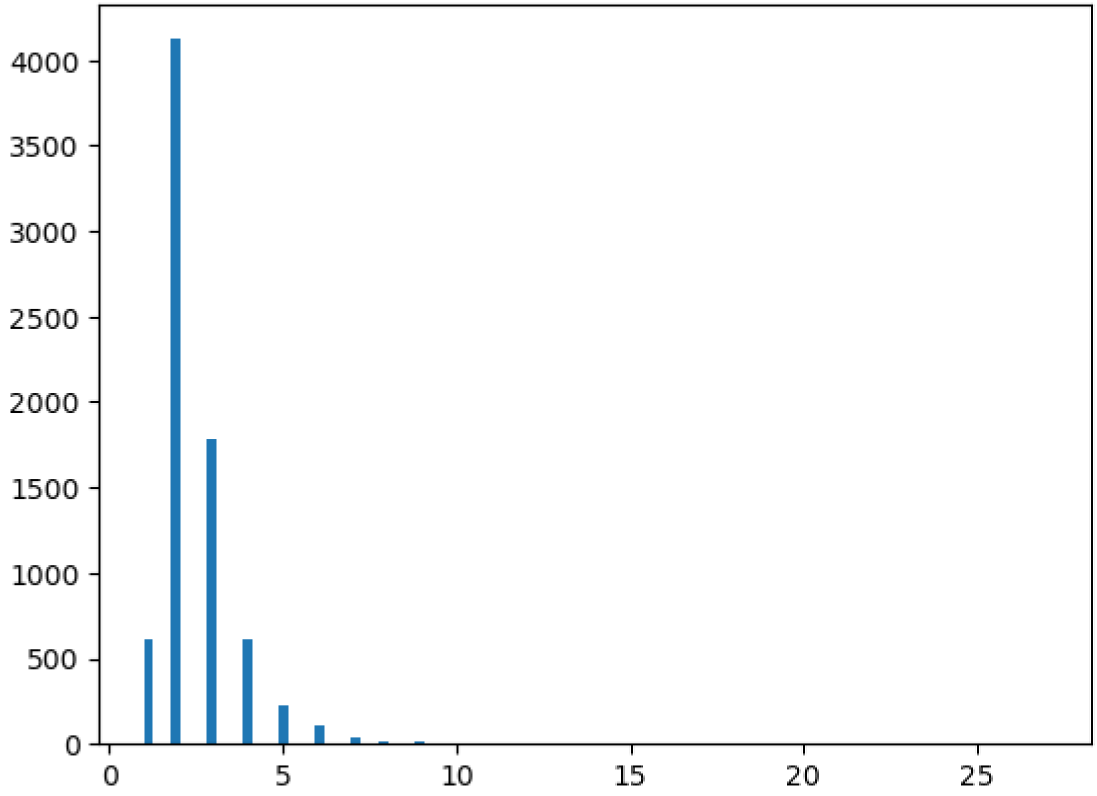
WE ARE GOING TO STAY OK WITH THIS. BUT WE WILL BE CONSERNED WITH THE APARTS WITH BATHROOMS ARE MORETHAN BEROOMS+2 SO WE ARE GONNA REMOVE THEM

In [68]:

```
plt.hist(df.bath,bins=100)
```

Out[68]:

```
(array([6.090e+02, 0.000e+00, 0.000e+00, 4.122e+03, 0.000e+00, 0.000e+00,
        0.000e+00, 1.785e+03, 0.000e+00, 0.000e+00, 0.000e+00, 6.180e+02,
        0.000e+00, 0.000e+00, 0.000e+00, 2.220e+02, 0.000e+00, 0.000e+00,
        0.000e+00, 1.140e+02, 0.000e+00, 0.000e+00, 0.000e+00, 3.400e+01,
        0.000e+00, 0.000e+00, 2.000e+01, 0.000e+00, 0.000e+00, 0.000e+00,
        1.200e+01, 0.000e+00, 0.000e+00, 0.000e+00, 2.000e+00, 0.000e+00,
        0.000e+00, 0.000e+00, 1.000e+00, 0.000e+00, 0.000e+00, 0.000e+00,
        0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 1.000e+00, 0.000e+00,
        0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 1.000e+00,
        0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00,
        0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00,
        0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00,
        0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00,
        0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00,
        0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00,
        0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00, 0.000e+00,
        0.000e+00, 0.000e+00, 0.000e+00, 1.000e+00]),
 array([ 1.  ,  1.26,  1.52,  1.78,  2.04,  2.3 ,  2.56,  2.82,  3.08,
         3.34,  3.6 ,  3.86,  4.12,  4.38,  4.64,  4.9 ,  5.16,  5.42,
         5.68,  5.94,  6.2 ,  6.46,  6.72,  6.98,  7.24,  7.5 ,  7.76,
         8.02,  8.28,  8.54,  8.8 ,  9.06,  9.32,  9.58,  9.84, 10.1 ,
        10.36, 10.62, 10.88, 11.14, 11.4 , 11.66, 11.92, 12.18, 12.44,
        12.7 , 12.96, 13.22, 13.48, 13.74, 14.  , 14.26, 14.52, 14.78,
        15.04, 15.3 , 15.56, 15.82, 16.08, 16.34, 16.6 , 16.86, 17.12,
        17.38, 17.64, 17.9 , 18.16, 18.42, 18.68, 18.94, 19.2 , 19.46,
        19.72, 19.98, 20.24, 20.5 , 20.76, 21.02, 21.28, 21.54, 21.8 ,
        22.06, 22.32, 22.58, 22.84, 23.1 , 23.36, 23.62, 23.88, 24.14,
        24.4 , 24.66, 24.92, 25.18, 25.44, 25.7 , 25.96, 26.22, 26.48,
        26.74, 27.  ]),
 <BarContainer object of 100 artists>)
```



In [69]:
```
buffer_df=df.copy()
buffer_df=buffer_df[buffer_df.bath<buffer_df.bhk+2]
buffer_df.shape
```

Out[69]:
```
(7459, 7)
```

In [70]:
```
df=buffer_df.copy()
df
```

Out[70]:

	location	bhk	total_sqft	bath	balcony	price	price_per_sqft
0	1st Block Jayanagar	4	2850.0	4.0	1.0	428.0	15017.543860
1	1st Block Jayanagar	3	1630.0	3.0	2.0	194.0	11901.840491
2	1st Block Jayanagar	6	1200.0	6.0	2.0	125.0	10416.666667
3	1st Block Jayanagar	3	1875.0	2.0	3.0	235.0	12533.333333
4	1st Block Jayanagar	7	930.0	4.0	2.0	85.0	9139.784946
...	...	...	...	...	...	...	...
10817	other	1	1800.0	1.0	1.0	200.0	11111.111111
10818	other	3	2000.0	2.0	2.0	360.0	18000.000000
10819	other	2	1140.0	1.0	1.0	185.0	16228.070175
10822	other	2	1353.0	2.0	2.0	110.0	8130.081301
10823	other	1	812.0	1.0	0.0	26.0	3201.970443

7459 rows × 7 columns

In [ ]:

MODEL BUILDING

In [71]:

```
df.drop(['price_per_sqft','balcony'],axis=1,inplace=True)
df
```

Out[71]:

	location	bhk	total_sqft	bath	price
0	1st Block Jayanagar	4	2850.0	4.0	428.0
1	1st Block Jayanagar	3	1630.0	3.0	194.0
2	1st Block Jayanagar	6	1200.0	6.0	125.0
3	1st Block Jayanagar	3	1875.0	2.0	235.0
4	1st Block Jayanagar	7	930.0	4.0	85.0
...	...	...	...	...	...
10817	other	1	1800.0	1.0	200.0
10818	other	3	2000.0	2.0	360.0
10819	other	2	1140.0	1.0	185.0
10822	other	2	1353.0	2.0	110.0
10823	other	1	812.0	1.0	26.0

7459 rows × 5 columns

In [72]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 7459 entries, 0 to 10823
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   location    7459 non-null   object 
 1   bhk         7459 non-null   int64  
 2   total_sqft  7459 non-null   float64
 3   bath        7459 non-null   float64
 4   price       7459 non-null   float64
dtypes: float64(3), int64(1), object(1)
memory usage: 349.6+ KB
```

WE SHOULD CHANGE THE LOCATION VARIABLE TO NUMERICAL FORM WE WILL USE ONE-HOT ENCODING

In [73]:

```
dummies=pd.get_dummies(df.location)
dummies.head(3)
```

Out[73]:

	1st Block Jayanagar	1st Phase JP Nagar	2nd Phase Judicial Layout	2nd Stage Nagarbhavi	5th Phase JP Nagar	6th Phase JP Nagar	7th Phase JP Nagar	8th Phase JP Nagar	9th Phase JP Nagar	AECS Layout	...	Vi
0	1	0	0	0	0	0	0	0	0	0	...	
1	1	0	0	0	0	0	0	0	0	0	...	
2	1	0	0	0	0	0	0	0	0	0	...	

3 rows × 236 columns

In [74]:

```
new_df=pd.concat([df,dummies.drop('other',axis=1)],axis='columns')
new_df.drop('location',axis=1,inplace=True)
```

In [75]:
```
new_df.head(3)
```

Out[75]:

	bhk	total_sqft	bath	price	1st Block Jayanagar	1st Phase JP Nagar	2nd Phase Judicial Layout	2nd Stage Nagarbhavi	5th Phase JP Nagar	6th Phase JP Nagar	...	Vijay
0	4	2850.0	4.0	428.0	1	0	0	0	0	0	...	
1	3	1630.0	3.0	194.0	1	0	0	0	0	0	...	
2	6	1200.0	6.0	125.0	1	0	0	0	0	0	...	

3 rows × 239 columns

In [76]:
```
y_in=new_df.price
```

In [77]:
```
x_in=new_df.drop('price',axis=1)
```

In [78]:
```
from sklearn.model_selection import train_test_split
X,x,Y,y=train_test_split(x_in,y_in,test_size=0.2)
```

In [79]:
```
from sklearn.linear_model import LinearRegression
LinReg=LinearRegression()
LinReg.fit(X,Y)
LinReg.score(x,y)
```

Out[79]:
```
0.6573977475359556
```

In [ ]:

In [80]:
```
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_in,y_in,cv=cv)
```

Out[80]:
```
array([0.64816506, 0.68495204, 0.67505946, 0.65351523, 0.75595903])
```

In [ ]:

In [81]:
```
from sklearn.model_selection import GridSearchCV

from sklearn.linear_model import Lasso
from sklearn.tree import DecisionTreeRegressor

def find_best_model_using_gridsearchcv(x,y):
    algos={
        'linear_regression':{
            'model': LinearRegression(),
            'params':{
#                 'normalize':[True,False]
            }
        },
        'lasso':
        {
            'model': Lasso(),
            'params':{
                'alpha':[1,2],
                'selection':['random','cyclic']
            }
        },
        'decision_tree':
        {
            'model':DecisionTreeRegressor(),
            'params':{
                'criterion':['squared_error','friedman_mse'],
                'splitter':['best','random']
            }
        }
    }

    scores=[]
    cv=ShuffleSplit(n_splits=5,test_size=0.2,random_state=0)
    for algo_name,config in algos.items():
        gs=GridSearchCV(config['model'],config['params'],cv=cv,return_train_
        gs.fit(x,y)
        scores.append({
            'model':algo_name,
            'best_score':gs.best_score_,
            'best_params':gs.best_params_
        })
    return pd.DataFrame(scores,columns=['model','best_score','best_params']
```

In [82]:

```
find_best_model_using_gridsearchcv(x_in,y_in)
```

Out[82]:

	model	best_score	best_params
0	linear_regression	0.683530	{}
1	lasso	0.598604	{'alpha': 1, 'selection': 'cyclic'}
2	decision_tree	0.471466	{'criterion': 'squared_error', 'splitter': 'ra...

In [ ]:

AS LINEAR REGRESSION WORKS BEST IN THIS CASE WE CAN JUST USE THE LinReg WHICH IS CREATED FOR PREDICTION

In [83]:

```
LinReg
```

Out[83]:

```
▾ LinearRegression
LinearRegression()
```

In [84]:

```
x_in.columns
```

Out[84]:

```
Index(['bhk', 'total_sqft', 'bath', '1st Block Jayanagar',
       '1st Phase JP Nagar', '2nd Phase Judicial Layout',
       '2nd Stage Nagarbhavi', '5th Phase JP Nagar', '6th Phase JP Nagar',
       '7th Phase JP Nagar',
       ...
       'Vijayanagar', 'Vishveshwarya Layout', 'Vishwapriya Layout',
       'Vittasandra', 'Whitefield', 'Yelachenahalli', 'Yelahanka',
       'Yelahanka New Town', 'Yelenahalli', 'Yeshwanthpur'],
      dtype='object', length=238)
```

In [85]:

```
loc_index=np.where(x_in.columns=='1st Phase JP Nagar')[0][0]
loc_index
```

Out[85]:

```
4
```

In [86]:

```python
def predict_price(location,sqft,bath,bhk):
    loc_index=np.where(x_in.columns==location)[0][0]

    x1=np.zeros(len(x_in.columns))
    x1[0]=bhk
    x1[1]=sqft
    x1[2]=bath
    if loc_index >=0:
        x[loc_index]=1
    return LinReg.predict([x1])[0]
```

In [87]:

```python
predict_price('1st Phase JP Nagar',2000,2,2)
```

```
/home/kali/.local/lib/python3.11/site-packages/sklearn/base.py:465: UserWar
ning: X does not have valid feature names, but LinearRegression was fitted
with feature names
  warnings.warn(
```

Out[87]:

```
250.02770390131153
```

In [88]:

```python
predict_price('1st Phase JP Nagar',2000,3,3)
```

```
/home/kali/.local/lib/python3.11/site-packages/sklearn/base.py:465: UserWar
ning: X does not have valid feature names, but LinearRegression was fitted
with feature names
  warnings.warn(
```

Out[88]:

```
242.93949437722142
```

MODEL IS NOT GOOD BUT OK FOR NOW

In [ ]:

In [89]:

```python
import pickle
with open('banglore_home_prices_model.pickle','wb') as f:
    pickle.dump(LinReg,f)
```

In [91]:

```python
import json
columns={
    'data_columns' : [col.lower() for col in x_in.columns]
}

with open('columns.json','w') as f:
    f.write(json.dumps(columns))
```

In [ ]: