In [47]:
```
import pandas as pd
import numpy as np
```

In [2]:
```
df = pd.read_csv('car data.csv')
```

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

Out[3]:

	Car_Name	Year	Selling_Price	Present_Price	Kms_Driven	Fuel_Type	Seller_Type	Transmission	Owner
0	ritz	2014	3.35	5.59	27000	Petrol	Dealer	Manual	0
1	sx4	2013	4.75	9.54	43000	Diesel	Dealer	Manual	0
2	ciaz	2017	7.25	9.85	6900	Petrol	Dealer	Manual	0
3	wagon r	2011	2.85	4.15	5200	Petrol	Dealer	Manual	0
4	swift	2014	4.60	6.87	42450	Diesel	Dealer	Manual	0

In [5]:
```
df.shape
```

Out[5]:
```
(301, 9)
```

In [7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 301 entries, 0 to 300
Data columns (total 9 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   Car_Name       301 non-null    object 
 1   Year           301 non-null    int64  
 2   Selling_Price  301 non-null    float64
 3   Present_Price  301 non-null    float64
 4   Kms_Driven     301 non-null    int64  
 5   Fuel_Type      301 non-null    object 
 6   Seller_Type    301 non-null    object 
 7   Transmission   301 non-null    object 
 8   Owner          301 non-null    int64  
dtypes: float64(2), int64(3), object(4)
memory usage: 21.3+ KB
```

In [28]:
```
print(df['Seller_Type'].unique())
print(df['Transmission'].unique())
print(df['Owner'].unique())
print(df['Fuel_Type'].unique())
```

```
['Dealer' 'Individual']
['Manual' 'Automatic']
[0 1 3]
['Petrol' 'Diesel' 'CNG']
```

Check Missing or Null Values

In [11]:
```
df.isnull().sum()
```

Out[11]:
```
Car_Name         0
Year             0
Selling_Price    0
Present_Price    0
Kms_Driven       0
Fuel_Type        0
Seller_Type      0
Transmission     0
Owner            0
dtype: int64
```

In [12]:
```
df.describe()
```

Out[12]:

	Year	Selling_Price	Present_Price	Kms_Driven	Owner
count	301.000000	301.000000	301.000000	301.000000	301.000000
mean	2013.627907	4.661296	7.628472	36947.205980	0.043189
std	2.891554	5.082812	8.644115	38886.883882	0.247915
min	2003.000000	0.100000	0.320000	500.000000	0.000000
25%	2012.000000	0.900000	1.200000	15000.000000	0.000000
50%	2014.000000	3.600000	6.400000	32000.000000	0.000000
75%	2016.000000	6.000000	9.900000	48767.000000	0.000000
max	2018.000000	35.000000	92.600000	500000.000000	3.000000

In [14]:
```
df.columns
```

Out[14]:
```
Index(['Car_Name', 'Year', 'Selling_Price', 'Present_Price', 'Kms_Driven',
       'Fuel_Type', 'Seller_Type', 'Transmission', 'Owner'],
      dtype='object')
```

In [18]:
```
final_dataset = df[['Year', 'Selling_Price', 'Present_Price', 'Kms_Driven',
                    'Fuel_Type', 'Seller_Type', 'Transmission', 'Owner']]
```

In [19]:
```
final_dataset.head()
```

Out[19]:

	Year	Selling_Price	Present_Price	Kms_Driven	Fuel_Type	Seller_Type	Transmission	Owner
0	2014	3.35	5.59	27000	Petrol	Dealer	Manual	0
1	2013	4.75	9.54	43000	Diesel	Dealer	Manual	0
2	2017	7.25	9.85	6900	Petrol	Dealer	Manual	0
3	2011	2.85	4.15	5200	Petrol	Dealer	Manual	0
4	2014	4.60	6.87	42450	Diesel	Dealer	Manual	0

In [20]:
```
final_dataset['Current_Year']=2023
```

In [21]:
```
final_dataset.head()
```

Out[21]:

	Year	Selling_Price	Present_Price	Kms_Driven	Fuel_Type	Seller_Type	Transmission	Owner	Current_Year
0	2014	3.35	5.59	27000	Petrol	Dealer	Manual	0	2023
1	2013	4.75	9.54	43000	Diesel	Dealer	Manual	0	2023
2	2017	7.25	9.85	6900	Petrol	Dealer	Manual	0	2023
3	2011	2.85	4.15	5200	Petrol	Dealer	Manual	0	2023
4	2014	4.60	6.87	42450	Diesel	Dealer	Manual	0	2023

In [22]:
```
final_dataset['no_year'] = final_dataset['Current_Year'] - final_dataset['Year']
```

In [23]:
```
final_dataset.head()
```

Out[23]:

	Year	Selling_Price	Present_Price	Kms_Driven	Fuel_Type	Seller_Type	Transmission	Owner	Current_Year	no_year
0	2014	3.35	5.59	27000	Petrol	Dealer	Manual	0	2023	9
1	2013	4.75	9.54	43000	Diesel	Dealer	Manual	0	2023	10
2	2017	7.25	9.85	6900	Petrol	Dealer	Manual	0	2023	6
3	2011	2.85	4.15	5200	Petrol	Dealer	Manual	0	2023	12
4	2014	4.60	6.87	42450	Diesel	Dealer	Manual	0	2023	9

In [24]:
```
final_dataset.drop(['Year'],axis=1,inplace=True)
```

In [26]:
```
final_dataset.drop(['Current_Year'],axis=1,inplace=True)
```

In [27]:
```
final_dataset.head()
```

Out[27]:

	Selling_Price	Present_Price	Kms_Driven	Fuel_Type	Seller_Type	Transmission	Owner	no_year
0	3.35	5.59	27000	Petrol	Dealer	Manual	0	9
1	4.75	9.54	43000	Diesel	Dealer	Manual	0	10
2	7.25	9.85	6900	Petrol	Dealer	Manual	0	6
3	2.85	4.15	5200	Petrol	Dealer	Manual	0	12
4	4.60	6.87	42450	Diesel	Dealer	Manual	0	9

In [29]:
```
final_dataset = pd.get_dummies(final_dataset,drop_first=True)
```

In [30]:
```
final_dataset.head()
```

Out[30]:

	Selling_Price	Present_Price	Kms_Driven	Owner	no_year	Fuel_Type_Diesel	Fuel_Type_Petrol	Seller_Type_Individual	Transmission_Manual
0	3.35	5.59	27000	0	9	0	1	0	1
1	4.75	9.54	43000	0	10	1	0	0	1
2	7.25	9.85	6900	0	6	0	1	0	1
3	2.85	4.15	5200	0	12	0	1	0	1
4	4.60	6.87	42450	0	9	1	0	0	1

In [31]:
```
final_dataset.corr()
```

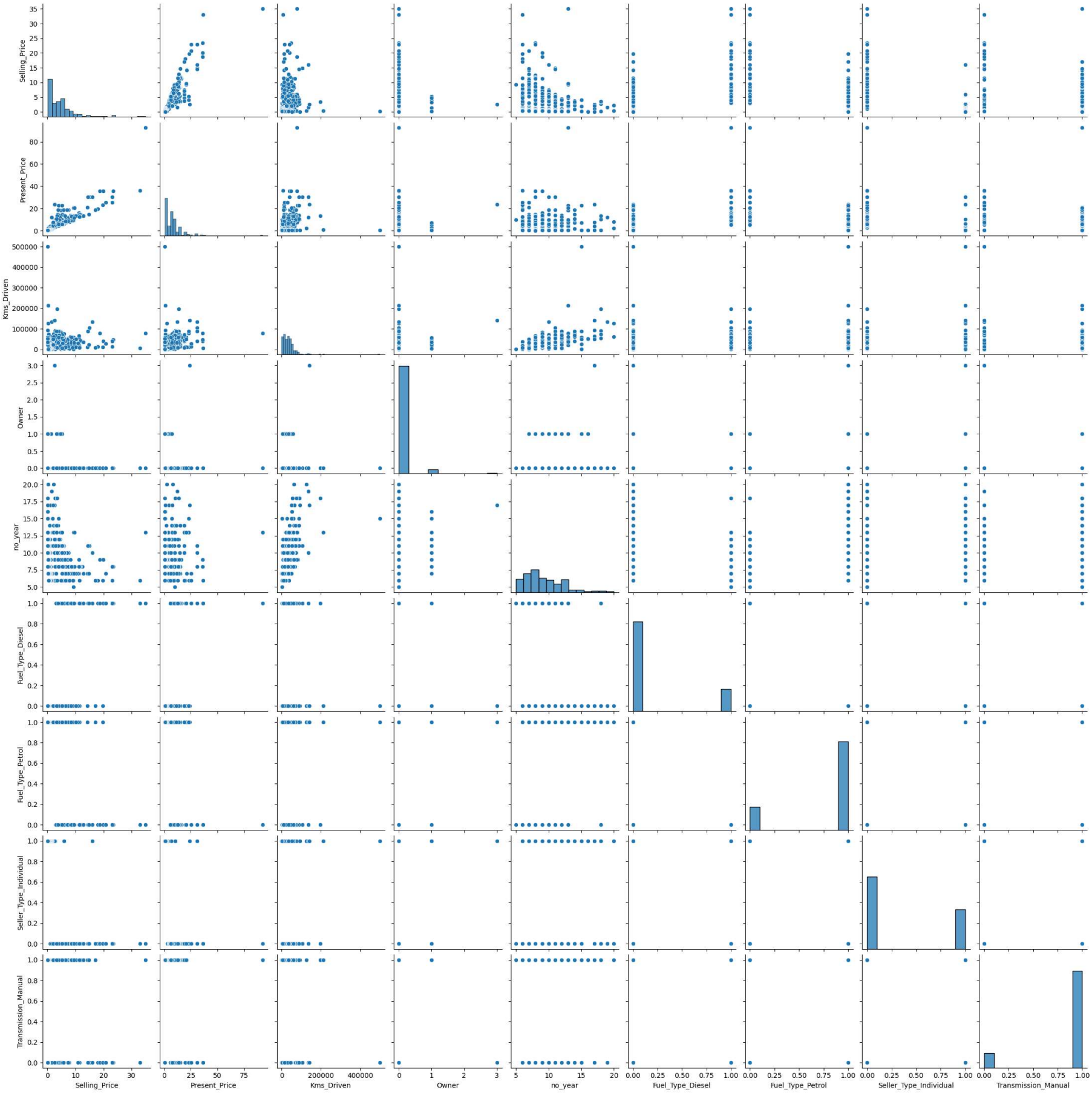
Out[31]:

	Selling_Price	Present_Price	Kms_Driven	Owner	no_year	Fuel_Type_Diesel	Fuel_Type_Petrol	Seller_Type_Individual	Transn
Selling_Price	1.000000	0.878983	0.029187	-0.088344	-0.236141	0.552339	-0.540571	-0.550724	
Present_Price	0.878983	1.000000	0.203647	0.008057	0.047584	0.473306	-0.465244	-0.512030	
Kms_Driven	0.029187	0.203647	1.000000	0.089216	0.524342	0.172515	-0.172874	-0.101419	
Owner	-0.088344	0.008057	0.089216	1.000000	0.182104	-0.053469	0.055687	0.124269	
no_year	-0.236141	0.047584	0.524342	0.182104	1.000000	-0.064315	0.059959	0.039896	
Fuel_Type_Diesel	0.552339	0.473306	0.172515	-0.053469	-0.064315	1.000000	-0.979648	-0.350467	
Fuel_Type_Petrol	-0.540571	-0.465244	-0.172874	0.055687	0.059959	-0.979648	1.000000	0.358321	
Seller_Type_Individual	-0.550724	-0.512030	-0.101419	0.124269	0.039896	-0.350467	0.358321	1.000000	
Transmission_Manual	-0.367128	-0.348715	-0.162510	-0.050316	-0.000394	-0.098643	0.091013	0.063240	

In [32]:
```
import seaborn as sns
```

In [33]:
```
sns.pairplot(final_dataset)
```

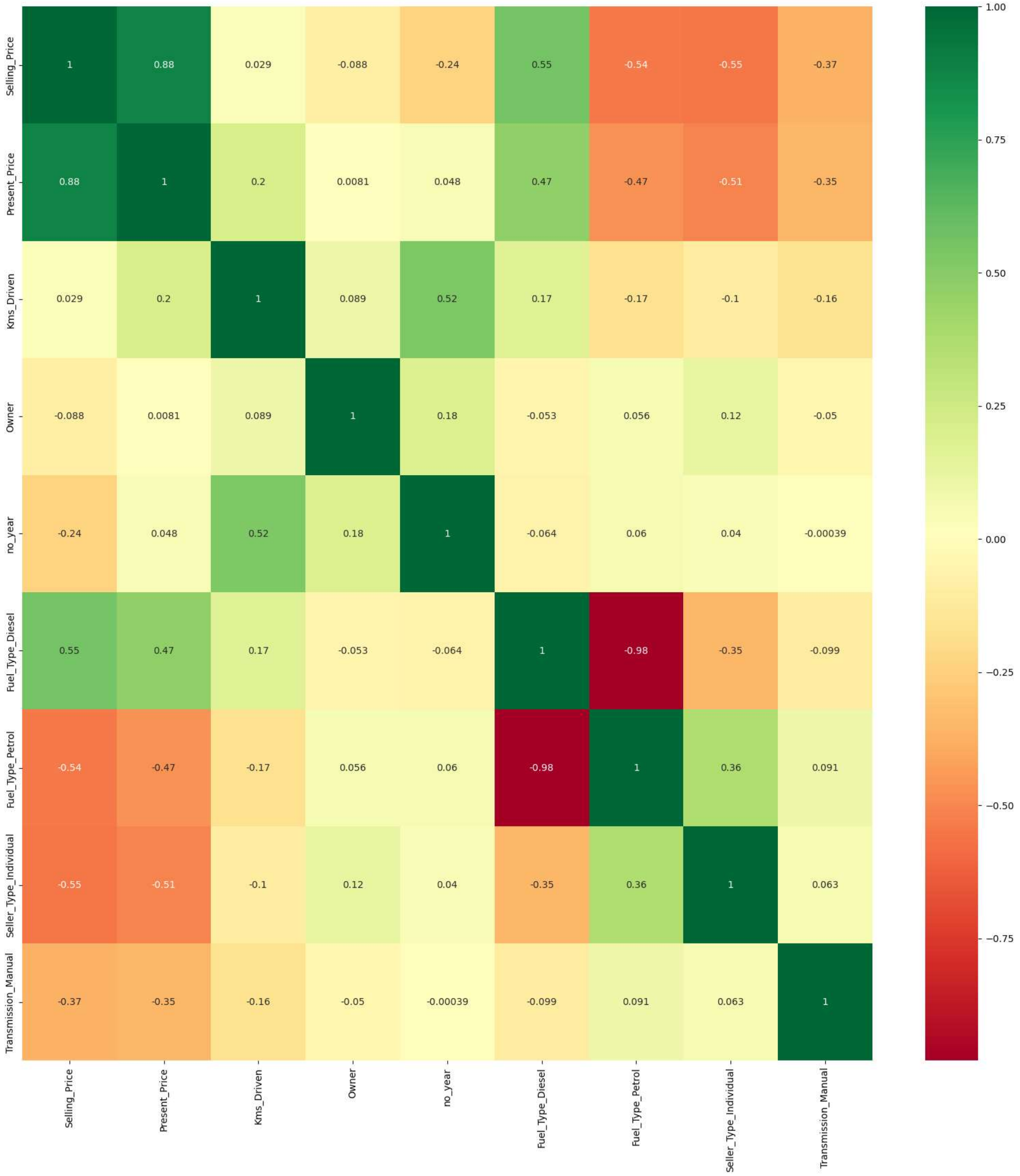
Out[33]:
```
<seaborn.axisgrid.PairGrid at 0x2b49ca0a530>
```



In [35]:
```
import matplotlib.pyplot as plt
%matplotlib inline
```

In [36]:
```
corrmat = final_dataset.corr()
top_corr_features = corrmat.index
```

```
plt.figure(figsize=(20,20))
g = sns.heatmap(final_dataset[top_corr_features].corr(),annot=True,cmap="RdYlGn")
plt.show()
```



In [37]:
```
final_dataset.head()
```

Out[37]:

	Selling_Price	Present_Price	Kms_Driven	Owner	no_year	Fuel_Type_Diesel	Fuel_Type_Petrol	Seller_Type_Individual	Transmission_Manual
0	3.35	5.59	27000	0	9	0	1	0	1
1	4.75	9.54	43000	0	10	1	0	0	1
2	7.25	9.85	6900	0	6	0	1	0	1
3	2.85	4.15	5200	0	12	0	1	0	1
4	4.60	6.87	42450	0	9	1	0	0	1

In [38]:
```
#independent and dependent features
x = final_dataset.iloc[:,1:] #independent feature
y = final_dataset.iloc[:,0] #dependent feature(selling price)
```

In [39]:
```
x.head()
```

Out[39]:

	Present_Price	Kms_Driven	Owner	no_year	Fuel_Type_Diesel	Fuel_Type_Petrol	Seller_Type_Individual	Transmission_Manual
0	5.59	27000	0	9	0	1	0	1
1	9.54	43000	0	10	1	0	0	1
2	9.85	6900	0	6	0	1	0	1
3	4.15	5200	0	12	0	1	0	1
4	6.87	42450	0	9	1	0	0	1

In [40]:
```
y.head()
```

Out[40]:
```
0    3.35
1    4.75
2    7.25
3    2.85
4    4.60
Name: Selling_Price, dtype: float64
```

Feature Importance

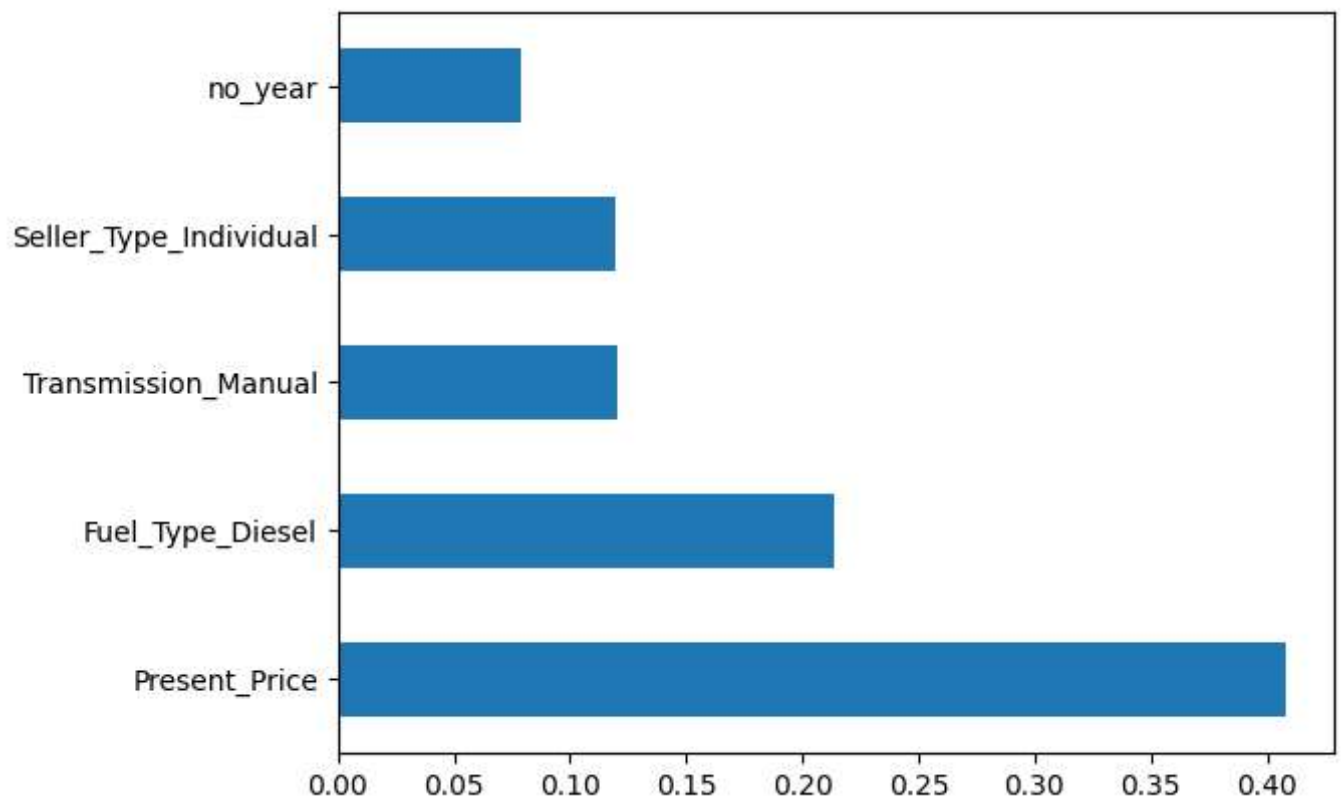
In [41]:
```
from sklearn.ensemble import ExtraTreesRegressor
model=ExtraTreesRegressor()
model.fit(x,y)
```

Out[41]:
```
ExtraTreesRegressor()
```

In [42]:
```
print(model.feature_importances_)
```

```
[0.4081853  0.04053097 0.00042921 0.07918338 0.21367046 0.01849998
 0.11955993 0.11994078]
```

In [43]:
```
#plot graph of feature importance for better visualization
feat_importances = pd.Series(model.feature_importances_,index=x.columns)
feat_importances.nlargest(5).plot(kind='barh')
plt.show()
```



In [44]:
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size=0.2)
```

In [45]:
```
x_train.shape
```

Out[45]:
```
(240, 8)
```

In [46]:
```
from sklearn.ensemble import RandomForestRegressor
rf_random=RandomForestRegressor()
```

In [51]:
```
#Hyperparameters
#Number of trees in random forest
n_estimators = [int(x) for x in np.linspace(start=100,stop=1200,num=12)]
#Number of features to consider at each split
max_features = ['auto','sqrt']
#Maximum number of levels in tree
max_depth = [int(x) for x in np.linspace(5,30,num=6)]

#maximum number of samples required to split a node
min_samples_split = [2,5,10,15,100]
```

```
#minimum number of samples required at leaf node
min_samples_leaf = [1,2,5,10]
```

In [52]:
```
from sklearn.model_selection import RandomizedSearchCV
```

In [53]:
```
random_grid = {
    'n_estimators':n_estimators,
    'max_features':max_features,
    'max_depth':max_depth,
    'min_samples_split':min_samples_split,
    'min_samples_leaf':min_samples_leaf
}
print(random_grid)
```

```
{'n_estimators': [100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200], 'max_features': ['auto', 'sqrt'], 'max_dept
h': [5, 10, 15, 20, 25, 30], 'min_samples_split': [2, 5, 10, 15, 100], 'min_samples_leaf': [1, 2, 5, 10]}
```

In [54]:
```
#Random grid is used in order to get best hyperparameters
#Frst create the base model to tune
rf = RandomForestRegressor()
```

In [55]:
```
rf_random = RandomizedSearchCV(estimator=rf, param_distributions=random_grid, scoring='neg_mean_squared_error',n_iter=10, cv=5
```

In [56]:
```
rf_random.fit(x_train,y_train)
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=5, min_samples_split=5, n_estimators=900; total time=   0.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=5, min_samples_split=5, n_estimators=900; total time=   0.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=5, min_samples_split=5, n_estimators=900; total time=   0.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=5, min_samples_split=5, n_estimators=900; total time=   0.6s
[CV] END max_depth=10, max_features=sqrt, min_samples_leaf=5, min_samples_split=5, n_estimators=900; total time=   0.6s
[CV] END max_depth=15, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=1100; total time=   0.8s
[CV] END max_depth=15, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=1100; total time=   0.8s
[CV] END max_depth=15, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=1100; total time=   0.8s
[CV] END max_depth=15, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=1100; total time=   0.8s
[CV] END max_depth=15, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=1100; total time=   1.0s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=15, max_features=auto, min_samples_leaf=5, min_samples_split=100, n_estimators=300; total time=   0.2s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=15, max_features=auto, min_samples_leaf=5, min_samples_split=100, n_estimators=300; total time=   0.2s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=15, max_features=auto, min_samples_leaf=5, min_samples_split=100, n_estimators=300; total time=   0.2s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=15, max_features=auto, min_samples_leaf=5, min_samples_split=100, n_estimators=300; total time=   0.2s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=15, max_features=auto, min_samples_leaf=5, min_samples_split=100, n_estimators=300; total time=   0.2s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=15, max_features=auto, min_samples_leaf=5, min_samples_split=5, n_estimators=400; total time=   0.3s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=15, max_features=auto, min_samples_leaf=5, min_samples_split=5, n_estimators=400; total time=   0.3s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=15, max_features=auto, min_samples_leaf=5, min_samples_split=5, n_estimators=400; total time=   0.3s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=15, max_features=auto, min_samples_leaf=5, min_samples_split=5, n_estimators=400; total time=   0.3s
```

```
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=15, max_features=auto, min_samples_leaf=5, min_samples_split=5, n_estimators=400; total time=   0.3s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=20, max_features=auto, min_samples_leaf=10, min_samples_split=5, n_estimators=700; total time=   0.5s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=20, max_features=auto, min_samples_leaf=10, min_samples_split=5, n_estimators=700; total time=   0.5s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=20, max_features=auto, min_samples_leaf=10, min_samples_split=5, n_estimators=700; total time=   0.6s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=20, max_features=auto, min_samples_leaf=10, min_samples_split=5, n_estimators=700; total time=   0.6s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=20, max_features=auto, min_samples_leaf=10, min_samples_split=5, n_estimators=700; total time=   0.6s
[CV] END max_depth=25, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=1000; total time=   0.8s
[CV] END max_depth=25, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=1000; total time=   1.0s
[CV] END max_depth=25, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=1000; total time=   0.9s
[CV] END max_depth=25, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=1000; total time=   0.9s
[CV] END max_depth=25, max_features=sqrt, min_samples_leaf=1, min_samples_split=2, n_estimators=1000; total time=   0.9s
[CV] END max_depth=5, max_features=sqrt, min_samples_leaf=10, min_samples_split=15, n_estimators=1100; total time=   0.9s
[CV] END max_depth=5, max_features=sqrt, min_samples_leaf=10, min_samples_split=15, n_estimators=1100; total time=   0.9s
[CV] END max_depth=5, max_features=sqrt, min_samples_leaf=10, min_samples_split=15, n_estimators=1100; total time=   0.9s
[CV] END max_depth=5, max_features=sqrt, min_samples_leaf=10, min_samples_split=15, n_estimators=1100; total time=   0.8s
[CV] END max_depth=5, max_features=sqrt, min_samples_leaf=10, min_samples_split=15, n_estimators=1100; total time=   0.8s
[CV] END max_depth=15, max_features=sqrt, min_samples_leaf=1, min_samples_split=15, n_estimators=300; total time=   0.2s
[CV] END max_depth=15, max_features=sqrt, min_samples_leaf=1, min_samples_split=15, n_estimators=300; total time=   0.2s
[CV] END max_depth=15, max_features=sqrt, min_samples_leaf=1, min_samples_split=15, n_estimators=300; total time=   0.2s
[CV] END max_depth=15, max_features=sqrt, min_samples_leaf=1, min_samples_split=15, n_estimators=300; total time=   0.2s
[CV] END max_depth=15, max_features=sqrt, min_samples_leaf=1, min_samples_split=15, n_estimators=300; total time=   0.2s
[CV] END max_depth=5, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=700; total time=   0.5s
[CV] END max_depth=5, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=700; total time=   0.5s
[CV] END max_depth=5, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=700; total time=   0.5s
[CV] END max_depth=5, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=700; total time=   0.5s
[CV] END max_depth=5, max_features=sqrt, min_samples_leaf=2, min_samples_split=10, n_estimators=700; total time=   0.5s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=20, max_features=auto, min_samples_leaf=1, min_samples_split=15, n_estimators=700; total time=   0.6s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
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  warn(
[CV] END max_depth=20, max_features=auto, min_samples_leaf=1, min_samples_split=15, n_estimators=700; total time=   0.6s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
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  warn(
[CV] END max_depth=20, max_features=auto, min_samples_leaf=1, min_samples_split=15, n_estimators=700; total time=   0.6s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
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  warn(
[CV] END max_depth=20, max_features=auto, min_samples_leaf=1, min_samples_split=15, n_estimators=700; total time=   0.6s
C:\Users\shubh\AppData\Local\Programs\Python\Python310\lib\site-packages\sklearn\ensemble\_forest.py:413: FutureWarning: `max
_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past behaviour, explicitly set `max_feat
ures=1.0` or remove this parameter as it is also the default value for RandomForestRegressors and ExtraTreesRegressors.
  warn(
[CV] END max_depth=20, max_features=auto, min_samples_leaf=1, min_samples_split=15, n_estimators=700; total time=   0.6s
```

Out[56]:

```
▸ RandomizedSearchCV
▸ estimator: RandomForestRegressor
    ▸ RandomForestRegressor
```

In [57]:

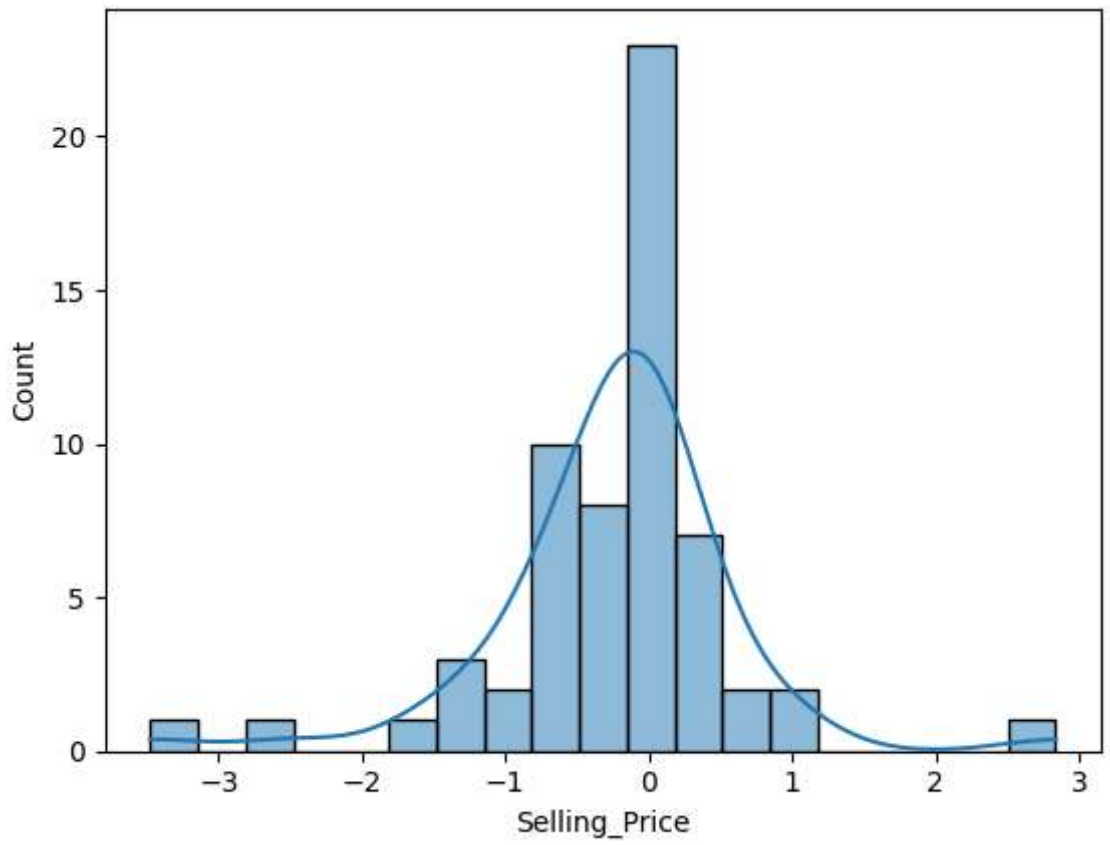
```python
predictions = rf_random.predict(x_test)
```

In [58]:
```
predictions
```

Out[58]:
```
array([ 8.52189,  0.50176,  5.39801,  3.37341,  0.78886,  1.39583,
        6.52147,  1.37178,  3.14813,  5.97256,  4.03216,  0.53326,
        0.32355, 10.21373,  4.04336,  5.74945,  0.43036,  3.8751 ,
        8.06685,  4.73819,  5.51812,  5.72391,  0.41593,  7.45853,
        0.67196,  0.58065,  6.99615,  4.59444,  0.96258,  2.66726,
        0.55823,  4.39465,  2.15045,  3.73452,  0.74877,  0.57005,
        0.52684,  1.04826,  3.71459,  3.9197 ,  0.85539,  2.92491,
        4.83557,  0.61142,  5.41368,  1.0781 ,  0.4116 ,  0.33602,
        1.10286,  3.49949,  5.76599, 12.07897,  4.9101 ,  0.25268,
        1.26014,  0.53182,  5.41859,  0.90635,  6.70895,  3.95881,
        0.5658 ])
```

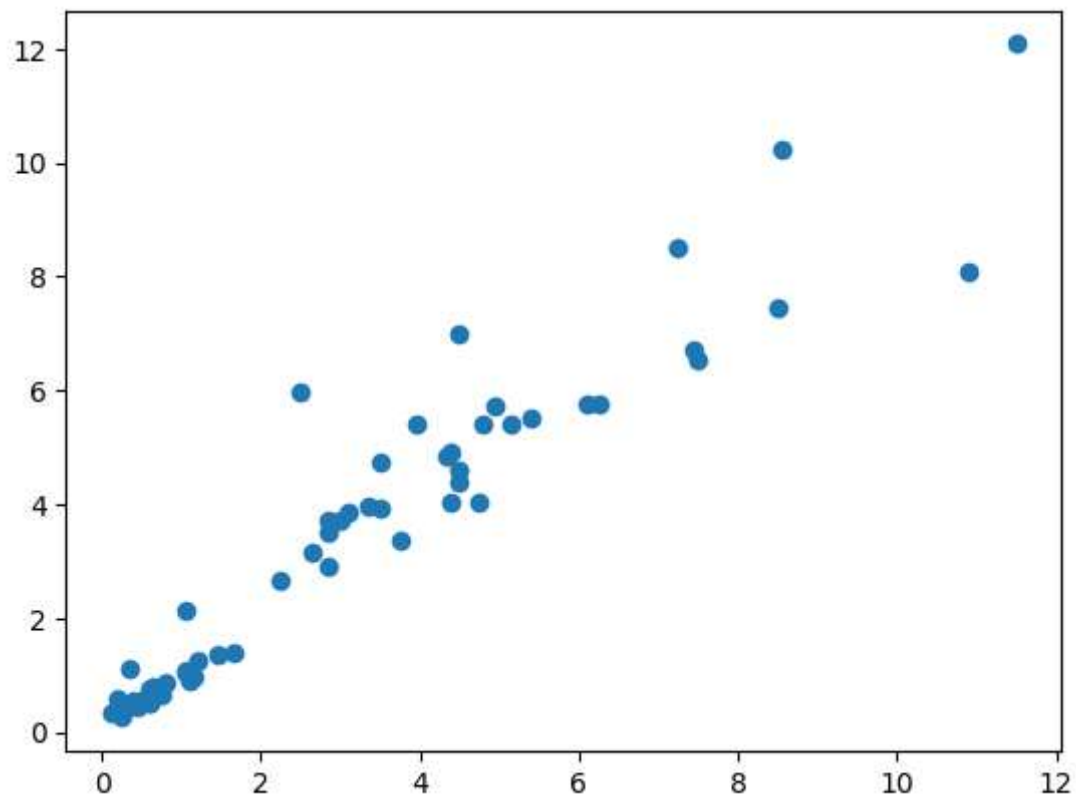
In [67]:
```
sns.histplot(y_test-predictions,kde=True)
```

Out[67]:
```
<AxesSubplot: xlabel='Selling_Price', ylabel='Count'>
```



In [64]:
```
plt.scatter(y_test,predictions)
```

Out[64]:
```
<matplotlib.collections.PathCollection at 0x2b4d0c0f9d0>
```



In [69]:
```
import pickle
#open file to store data
file = open('random_forest_regression_model.pkl','wb')

#dump info to the file
pickle.dump(rf_random,file)
```

In [ ]: