In [1]:
```python
import pandas as pd
import numpy as np
from sklearn.preprocessing import MinMaxScaler
import matplotlib.pyplot as plt
```

In [2]:
```python
data = pd.read_csv("GOOG.csv", date_parser=True)
```

In [3]:
```python
data.head()
```

Out[3]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	2004-08-19	2.490664	2.591785	2.390042	2.499133	2.499133	897427216
1	2004-08-20	2.515820	2.716817	2.503118	2.697639	2.697639	458857488
2	2004-08-23	2.758411	2.826406	2.716070	2.724787	2.724787	366857939
3	2004-08-24	2.770615	2.779581	2.579581	2.611960	2.611960	306396159
4	2004-08-25	2.614201	2.689918	2.587302	2.640104	2.640104	184645512

In [4]:
```python
data.tail()
```

Out[4]:

	Date	Open	High	Low	Close	Adj Close	Volume
4714	2023-05-11	115.860001	118.440002	114.930000	116.900002	116.900002	57115100
4715	2023-05-12	117.000000	118.260002	116.550003	117.919998	117.919998	31272500
4716	2023-05-15	116.489998	118.794998	116.480003	116.959999	116.959999	22107900
4717	2023-05-16	116.830002	121.199997	116.830002	120.089996	120.089996	32370100
4718	2023-05-17	120.180000	122.279999	119.459999	121.480003	121.480003	26651400

In [5]:
```python
training_data = data[data['Date'] < '2022-10-01'].copy()
data_training = training_data.copy()
```

In [6]:
```python
training_data.tail()
```

Out[6]:

	Date	Open	High	Low	Close	Adj Close	Volume
4557	2022-09-26	98.610001	100.440002	98.379997	98.809998	98.809998	22437900
4558	2022-09-27	99.910004	100.459999	97.339996	98.089996	98.089996	24225000
4559	2022-09-28	98.019997	101.400002	97.800003	100.739998	100.739998	24617000
4560	2022-09-29	99.300003	99.300003	96.519997	98.089996	98.089996	21921500
4561	2022-09-30	97.730003	99.494003	96.029999	96.150002	96.150002	26277800

In [7]:
```python
testing_data = data[data['Date'] >= '2022-10-01'].copy()
```

In [8]:
```python
testing_data
```

Out[8]:

	Date	Open	High	Low	Close	Adj Close	Volume
4562	2022-10-03	97.220001	99.970001	97.019997	99.300003	99.300003	24840000
4563	2022-10-04	101.040001	102.720001	101.040001	102.410004	102.410004	22580900

4564	2022-10-05	100.690002	102.739998	99.739998	102.220001	102.220001	18475500
4565	2022-10-06	101.500000	103.730003	101.500000	102.239998	102.239998	17156200
4566	2022-10-07	100.650002	101.419998	99.209999	99.570000	99.570000	24249900
...	...	...	...	...	...	...	...
4714	2023-05-11	115.860001	118.440002	114.930000	116.900002	116.900002	57115100
4715	2023-05-12	117.000000	118.260002	116.550003	117.919998	117.919998	31272500
4716	2023-05-15	116.489998	118.794998	116.480003	116.959999	116.959999	22107900
4717	2023-05-16	116.830002	121.199997	116.830002	120.089996	120.089996	32370100
4718	2023-05-17	120.180000	122.279999	119.459999	121.480003	121.480003	26651400

157 rows × 7 columns

In [9]:
```
training_data = training_data.drop(['Date', 'Adj Close'], axis = 1)
```

In [10]:
```
training_data.head()
```

Out[10]:

	Open	High	Low	Close	Volume
0	2.490664	2.591785	2.390042	2.499133	897427216
1	2.515820	2.716817	2.503118	2.697639	458857488
2	2.758411	2.826406	2.716070	2.724787	366857939
3	2.770615	2.779581	2.579581	2.611960	306396159
4	2.614201	2.689918	2.587302	2.640104	184645512

In [11]:
```
sc = MinMaxScaler()
training_data= sc.fit_transform(training_data)
training_data
```

Out[11]:
```
array([[1.35039790e-04, 3.86337794e-04, 0.00000000e+00, 5.54588186e-05,
        5.43577158e-01],
       [3.03427861e-04, 1.22230316e-03, 7.66630177e-04, 1.39474206e-03,
        2.77885883e-01],
       [1.92727230e-03, 1.95501646e-03, 2.21039746e-03, 1.57790459e-03,
        2.22151354e-01],
       ...,
       [6.39584879e-01, 6.61019198e-01, 6.46858354e-01, 6.62868392e-01,
        1.48173190e-02],
       [6.48152924e-01, 6.46978581e-01, 6.38180198e-01, 6.44989319e-01,
        1.31843499e-02],
       [6.37643730e-01, 6.48275667e-01, 6.34858120e-01, 6.31900539e-01,
        1.58234534e-02]])
```

In [12]:
```
X_train = []
y_train = []
```

In [13]:
```
training_data.shape[0]
```

Out[13]:
```
4562
```

In [14]:
```
for i in range(60, training_data.shape[0]):
    X_train.append(training_data[i - 60 : i])
    y_train.append(training_data[i, 0])
```

```
X_train, y_train = np.array(X_train), np.array(y_train)
```

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

Out[15]:
```
(4502, 60, 5)
```

In [16]:
```
y_train.shape
```

Out[16]:
```
(4502,)
```

In [17]:
```
from tensorflow.keras import Sequential
from tensorflow.keras.layers import LSTM, Dropout, Dense
```

In [18]:
```
model = Sequential()
```

In [19]:
```
model.add(LSTM(units = 60, activation = 'relu', return_sequences = True, input_shape = (
model.add(Dropout(0.2))

model.add(LSTM(units = 60, activation = 'relu', return_sequences = True))
model.add(Dropout(0.2))

model.add(LSTM(units = 80, activation = 'relu', return_sequences = True))
model.add(Dropout(0.2))

model.add(LSTM(units = 120, activation = 'relu'))
model.add(Dropout(0.2))


model.add(Dense(units = 1))
```

In [20]:
```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm (LSTM)                 (None, 60, 60)            15840

 dropout (Dropout)           (None, 60, 60)            0

 lstm_1 (LSTM)               (None, 60, 60)            29040

 dropout_1 (Dropout)         (None, 60, 60)            0

 lstm_2 (LSTM)               (None, 60, 80)            45120

 dropout_2 (Dropout)         (None, 60, 80)            0

 lstm_3 (LSTM)               (None, 120)               96480

 dropout_3 (Dropout)         (None, 120)               0

 dense (Dense)               (None, 1)                 121

=================================================================
Total params: 186,601
Trainable params: 186,601
Non-trainable params: 0
_________________________________________________________________
```

In [21]:
```
model.compile(optimizer = 'adam', loss = 'mean_squared_error')
```

In [22]:
```
X_train.shape
```
Out[22]:
```
(4502, 60, 5)
```
In [23]:
```
y_train.shape
```
Out[23]:
```
(4502,)
```
In [24]:
```
model.fit(X_train, y_train, epochs = 2, batch_size = 512)
```
```
Epoch 1/2
9/9 [==============================] - 8s 559ms/step - loss: 0.0630
Epoch 2/2
9/9 [==============================] - 5s 594ms/step - loss: 0.0124
```
Out[24]:
```
<keras.callbacks.History at 0x2795b46cf10>
```
In [25]:
```
testing_data.head()
```
Out[25]:

	Date	Open	High	Low	Close	Adj Close	Volume
4562	2022-10-03	97.220001	99.970001	97.019997	99.300003	99.300003	24840000
4563	2022-10-04	101.040001	102.720001	101.040001	102.410004	102.410004	22580900
4564	2022-10-05	100.690002	102.739998	99.739998	102.220001	102.220001	18475500
4565	2022-10-06	101.500000	103.730003	101.500000	102.239998	102.239998	17156200
4566	2022-10-07	100.650002	101.419998	99.209999	99.570000	99.570000	24249900

In [26]:
```
past_60_days = data_training.tail(60)
testing_data = past_60_days.append(testing_data, ignore_index = True)
testing_data = testing_data.drop(['Date', 'Adj Close'], axis = 1)
testing_data.head()
```
```
C:\Users\ayush\AppData\Local\Temp\ipykernel_3632\2343619103.py:2: FutureWarning: The fra
me.append method is deprecated and will be removed from pandas in a future version. Use
pandas.concat instead.
  testing_data = past_60_days.append(testing_data, ignore_index = True)
```
Out[26]:

	Open	High	Low	Close	Volume
0	117.550003	120.434998	117.514000	120.168503	29082000
1	118.650002	118.794502	116.234497	116.522499	26718000
2	116.838501	117.849503	114.614998	114.849503	24970000
3	112.639000	115.156998	111.822998	112.186996	38958000
4	110.825996	111.987503	109.325500	111.440002	32366000

In [27]:
```
testing_data = sc.transform(testing_data)
testing_data
```
Out[27]:
```
array([[0.77031393, 0.7882874 , 0.78051488, 0.79394892, 0.01752227],
       [0.77767705, 0.77731902, 0.77184013, 0.76935001, 0.01609013],
       [0.76555131, 0.77100075, 0.76086029, 0.75806261, 0.01503117],
       ...,
       [0.76321852, 0.77732234, 0.77350461, 0.77230174, 0.01329727],
       [0.76549442, 0.79340219, 0.77587752, 0.79341925, 0.01951425],
       [0.78791848, 0.80062309, 0.79370832, 0.80279737, 0.01604979]])
```
In [28]:
```
X_test = []
y_test = []
```

```
for i in range(60, testing_data.shape[0]):
    X_test.append(testing_data[i - 60 : i])
    y_test.append(testing_data[i, 0])

X_test, y_test = np.array(X_test), np.array(y_test)
X_test.shape, y_test.shape
```

Out[28]:
```
((157, 60, 5), (157,))
```

In [29]:
```
y_pred = model.predict(X_test)
```

```
5/5 [==============================] - 1s 27ms/step
```

In [30]:
```
type(X_test)
```

Out[30]:
```
numpy.ndarray
```

In [31]:
```
y_pred.shape
```

Out[31]:
```
(157, 1)
```

In [32]:
```
sc.scale_
```

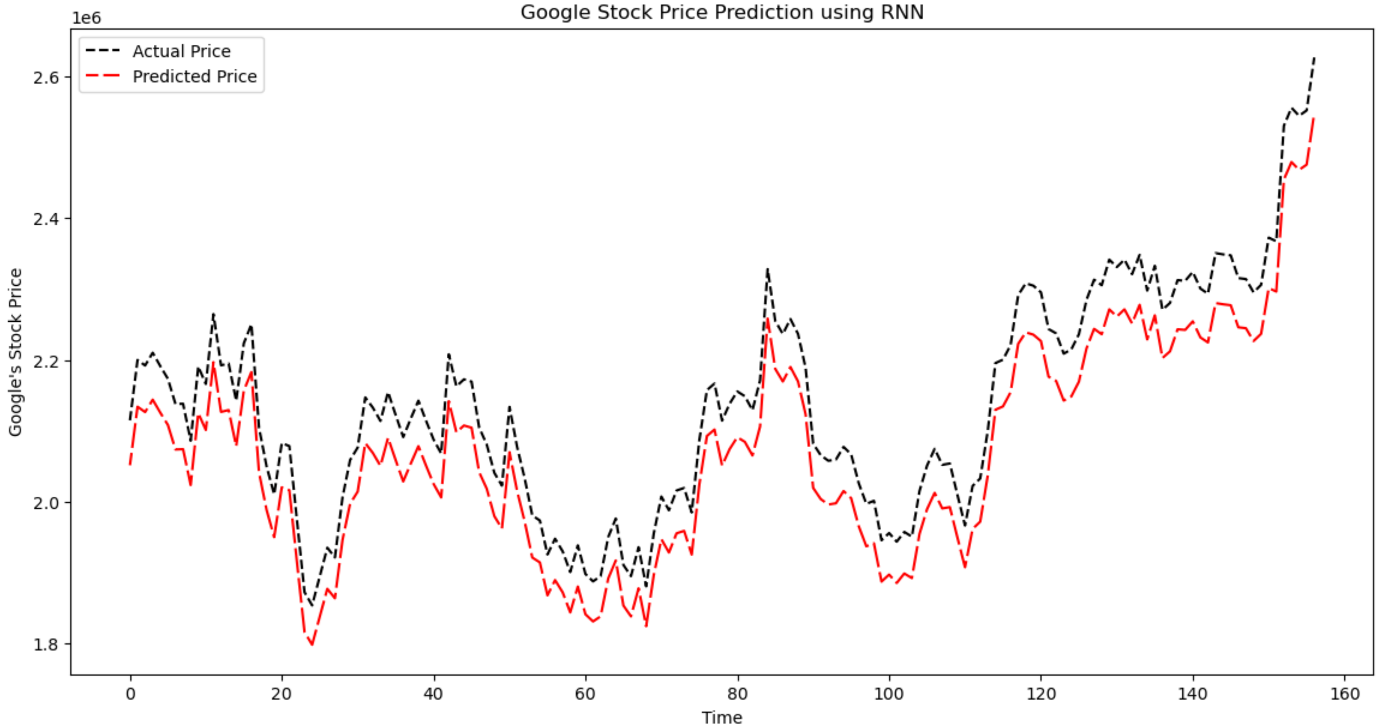
Out[32]:
```
array([6.69375383e-03, 6.68601135e-03, 6.77977800e-03, 6.74681491e-03,
       6.05813073e-10])
```

In [33]:
```
scale = 1/6.69375383e-03
scale
```

Out[33]:
```
149.39300509053825
```

In [39]:
```
y_pred = y_pred*scale
y_test = y_test*scale
```

In [40]:
```
# Visualising
plt.figure(figsize=(14,7))
plt.plot(y_test, color = 'black', label = 'Actual Price', linestyle='--')
plt.plot(y_pred, color = 'red', label = 'Predicted Price', linestyle=(5, (10, 2)))
plt.title('Google Stock Price Prediction using RNN')
plt.xlabel('Time')
plt.ylabel('Google\'s Stock Price')
plt.legend()
plt.show()
```


Google Stock Price Prediction using RNN
1e6
Actual Price
Predicted Price
2.6
2.4
2.2
2.0
1.8
Google's Stock Price
0
20
40
60
80
100
120
140
160
Time