In [1]:
```
# Importing library
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
```

In [2]:
```
# Importing training set
dataset_train = pd.read_csv('Google_Stock_Price_Train.csv')
training_set = dataset_train.iloc[:, 1:2].values
```

In [3]:
```
# feature scaling
from sklearn.preprocessing import MinMaxScaler
sc = MinMaxScaler(feature_range = (0,1))
training_set_scaled = sc.fit_transform(training_set)
```

In [4]:
```
# Creating a data scructure with 60 timesteps and 1 output
X_train = []
Y_train = []
for i in range (60, 1258):
    X_train.append(training_set_scaled[i-60:i, 0])
    Y_train.append(training_set_scaled[i, 0])
X_train, Y_train = np.array(X_train), np.array(Y_train)

# Reshaping
X_train = np.reshape(X_train, (X_train.shape[0], X_train.shape[1], 1))
```

In [5]:
```
# Importing KERAS
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
from keras.layers import Dropout
```

In [6]:
```
# Initializing the RNN
regressor = Sequential()

# Adding the first LSTM layer and some dropout regularization
regressor.add(LSTM(units=50, return_sequences=True, input_shape=(X_train.sh
regressor.add(Dropout(0.2))
```

In [7]:
```
# Adding second LSTM layer and some another dropout regularization
regressor.add(LSTM(units=50, return_sequences=True))
regressor.add(Dropout(0.2))
```

In [8]:
```
# Adding third LSTM layer and some another dropout regularization
regressor.add(LSTM(units=50, return_sequences=True))
regressor.add(Dropout(0.2))
```

In [9]:
```
# Adding fourth LSTM layer and some another dropout regularization
regressor.add(LSTM(units=50))
regressor.add(Dropout(0.2))
```

In [10]:
```
# Adding output layer
regressor.add(Dense(units=1))
```

In [11]:
```
# Compiling
regressor.compile(optimizer='adam', loss='mean_squared_error')
```

In [16]:
```
regressorting the RNN to training set
regressor.fit(X_train, Y_train, epochs=250, batch_size=32)
```

```
Epoch 1/250
38/38 [==============================] - 6s 145ms/step - loss: 0.0030
Epoch 2/250
38/38 [==============================] - 5s 131ms/step - loss: 0.0033
Epoch 3/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0029
Epoch 4/250
38/38 [==============================] - 6s 149ms/step - loss: 0.0034
Epoch 5/250
38/38 [==============================] - 5s 143ms/step - loss: 0.0028
Epoch 6/250
38/38 [==============================] - 6s 155ms/step - loss: 0.0032
Epoch 7/250
38/38 [==============================] - 6s 153ms/step - loss: 0.0028
Epoch 8/250
38/38 [==============================] - 5s 135ms/step - loss: 0.0029
Epoch 9/250
38/38 [==============================] - 6s 153ms/step - loss: 0.0028
Epoch 10/250
38/38 [==============================] - 6s 150ms/step - loss: 0.0030
Epoch 11/250
38/38 [==============================] - 5s 144ms/step - loss: 0.0028
Epoch 12/250
38/38 [==============================] - 6s 153ms/step - loss: 0.0026
Epoch 13/250
38/38 [==============================] - 6s 146ms/step - loss: 0.0029
Epoch 14/250
38/38 [==============================] - 5s 140ms/step - loss: 0.0025
Epoch 15/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0030
Epoch 16/250
38/38 [==============================] - 5s 136ms/step - loss: 0.0026
Epoch 17/250
38/38 [==============================] - 6s 148ms/step - loss: 0.0026
Epoch 18/250
38/38 [==============================] - 6s 150ms/step - loss: 0.0023
Epoch 19/250
38/38 [==============================] - 5s 131ms/step - loss: 0.0025
Epoch 20/250
38/38 [==============================] - 6s 150ms/step - loss: 0.0026
Epoch 21/250
38/38 [==============================] - 6s 150ms/step - loss: 0.0025
Epoch 22/250
38/38 [==============================] - 5s 130ms/step - loss: 0.0024
Epoch 23/250
38/38 [==============================] - 6s 148ms/step - loss: 0.0029
Epoch 24/250
38/38 [==============================] - 6s 149ms/step - loss: 0.0027
Epoch 25/250
38/38 [==============================] - 5s 132ms/step - loss: 0.0025
```

```
Epoch 26/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0024
Epoch 27/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0023
Epoch 28/250
38/38 [==============================] - 5s 136ms/step - loss: 0.0023
Epoch 29/250
38/38 [==============================] - 6s 150ms/step - loss: 0.0022
Epoch 30/250
38/38 [==============================] - 6s 148ms/step - loss: 0.0021
Epoch 31/250
38/38 [==============================] - 5s 142ms/step - loss: 0.0021
Epoch 32/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0024
Epoch 33/250
38/38 [==============================] - 6s 147ms/step - loss: 0.0022
Epoch 34/250
38/38 [==============================] - 5s 138ms/step - loss: 0.0022
Epoch 35/250
38/38 [==============================] - 6s 150ms/step - loss: 0.0022
Epoch 36/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0021
Epoch 37/250
38/38 [==============================] - 5s 140ms/step - loss: 0.0023
Epoch 38/250
38/38 [==============================] - 6s 151ms/step - loss: 0.0020
Epoch 39/250
38/38 [==============================] - 5s 142ms/step - loss: 0.0020
Epoch 40/250
38/38 [==============================] - 5s 139ms/step - loss: 0.0020
Epoch 41/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0020
Epoch 42/250
38/38 [==============================] - 5s 144ms/step - loss: 0.0020
Epoch 43/250
38/38 [==============================] - 5s 144ms/step - loss: 0.0017
Epoch 44/250
38/38 [==============================] - 6s 145ms/step - loss: 0.0020
Epoch 45/250
38/38 [==============================] - 5s 144ms/step - loss: 0.0019
Epoch 46/250
38/38 [==============================] - 6s 147ms/step - loss: 0.0025
Epoch 47/250
38/38 [==============================] - 6s 156ms/step - loss: 0.0019
Epoch 48/250
38/38 [==============================] - 5s 132ms/step - loss: 0.0018
Epoch 49/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0018
Epoch 50/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0017
Epoch 51/250
38/38 [==============================] - 5s 131ms/step - loss: 0.0018
Epoch 52/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0017
Epoch 53/250
38/38 [==============================] - 6s 148ms/step - loss: 0.0018
Epoch 54/250
38/38 [==============================] - 5s 132ms/step - loss: 0.0016
Epoch 55/250
38/38 [==============================] - 5s 145ms/step - loss: 0.0016
Epoch 56/250
38/38 [==============================] - 6s 151ms/step - loss: 0.0017
Epoch 57/250
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```
38/38 [==============================] - 5s 134ms/step - loss: 0.0017
Epoch 58/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0017
Epoch 59/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0016
Epoch 60/250
38/38 [==============================] - 5s 134ms/step - loss: 0.0016
Epoch 61/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0016
Epoch 62/250
38/38 [==============================] - 6s 149ms/step - loss: 0.0015
Epoch 63/250
38/38 [==============================] - 5s 130ms/step - loss: 0.0015
Epoch 64/250
38/38 [==============================] - 6s 154ms/step - loss: 0.0016
Epoch 65/250
38/38 [==============================] - 6s 155ms/step - loss: 0.0017
Epoch 66/250
38/38 [==============================] - 5s 130ms/step - loss: 0.0018
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38/38 [==============================] - 6s 149ms/step - loss: 0.0015
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38/38 [==============================] - 6s 149ms/step - loss: 0.0014
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38/38 [==============================] - 6s 154ms/step - loss: 0.0015
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Epoch 76/250
38/38 [==============================] - 6s 151ms/step - loss: 0.0016
Epoch 77/250
38/38 [==============================] - 5s 136ms/step - loss: 0.0016
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38/38 [==============================] - 6s 150ms/step - loss: 0.0015
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38/38 [==============================] - 6s 153ms/step - loss: 0.0013
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38/38 [==============================] - 6s 151ms/step - loss: 0.0015
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38/38 [==============================] - 6s 151ms/step - loss: 0.0014
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38/38 [==============================] - 6s 152ms/step - loss: 0.0014
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38/38 [==============================] - 5s 138ms/step - loss: 0.0014
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38/38 [==============================] - 6s 150ms/step - loss: 0.0014
Epoch 88/250
38/38 [==============================] - 6s 147ms/step - loss: 0.0014
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```
Epoch 89/250
38/38 [==============================] - 5s 136ms/step - loss: 0.0013
Epoch 90/250
38/38 [==============================] - 6s 150ms/step - loss: 0.0013
Epoch 91/250
38/38 [==============================] - 6s 153ms/step - loss: 0.0013
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38/38 [==============================] - 6s 151ms/step - loss: 0.0012
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Epoch 120/250
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38/38 [==============================] - 6s 147ms/step - loss: 0.0011
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38/38 [==============================] - 5s 136ms/step - loss: 0.0012
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Epoch 123/250
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Epoch 138/250
38/38 [==============================] - 5s 143ms/step - loss: 0.0010
Epoch 139/250
38/38 [==============================] - 6s 152ms/step - loss: 9.7593e-04
Epoch 140/250
38/38 [==============================] - 6s 151ms/step - loss: 0.0010
Epoch 141/250
38/38 [==============================] - 5s 134ms/step - loss: 0.0010
Epoch 142/250
38/38 [==============================] - 6s 148ms/step - loss: 0.0010
Epoch 143/250
38/38 [==============================] - 6s 149ms/step - loss: 0.0013
Epoch 144/250
38/38 [==============================] - 5s 143ms/step - loss: 0.0012
Epoch 145/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0010
Epoch 146/250
38/38 [==============================] - 6s 157ms/step - loss: 0.0011
Epoch 147/250
38/38 [==============================] - 5s 136ms/step - loss: 9.9366e-04
Epoch 148/250
38/38 [==============================] - 6s 149ms/step - loss: 0.0011
Epoch 149/250
38/38 [==============================] - 6s 154ms/step - loss: 0.0010
Epoch 150/250
38/38 [==============================] - 5s 139ms/step - loss: 0.0010
Epoch 151/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0010
```

```
Epoch 152/250
38/38 [==============================] - 6s 151ms/step - loss: 0.0010
Epoch 153/250
38/38 [==============================] - 5s 138ms/step - loss: 9.5745e-04
Epoch 154/250
38/38 [==============================] - 6s 151ms/step - loss: 0.0010
Epoch 155/250
38/38 [==============================] - 6s 147ms/step - loss: 0.0011
Epoch 156/250
38/38 [==============================] - 6s 149ms/step - loss: 0.0011
Epoch 157/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0011
Epoch 158/250
38/38 [==============================] - 5s 138ms/step - loss: 0.0012
Epoch 159/250
38/38 [==============================] - 6s 155ms/step - loss: 9.0357e-04
Epoch 160/250
38/38 [==============================] - 6s 150ms/step - loss: 0.0010
Epoch 161/250
38/38 [==============================] - 5s 136ms/step - loss: 0.0010
Epoch 162/250
38/38 [==============================] - 5s 139ms/step - loss: 0.0011
Epoch 163/250
38/38 [==============================] - 5s 144ms/step - loss: 9.9739e-04
Epoch 164/250
38/38 [==============================] - 5s 135ms/step - loss: 0.0012
Epoch 165/250
38/38 [==============================] - 6s 152ms/step - loss: 9.9564e-04
Epoch 166/250
38/38 [==============================] - 5s 142ms/step - loss: 9.4873e-04
Epoch 167/250
38/38 [==============================] - 5s 137ms/step - loss: 0.0010
Epoch 168/250
38/38 [==============================] - 6s 153ms/step - loss: 0.0010
Epoch 169/250
38/38 [==============================] - 6s 150ms/step - loss: 9.9963e-04
Epoch 170/250
38/38 [==============================] - 5s 132ms/step - loss: 9.1730e-04
Epoch 171/250
38/38 [==============================] - 6s 147ms/step - loss: 0.0011
Epoch 172/250
38/38 [==============================] - 5s 131ms/step - loss: 9.2256e-04
Epoch 173/250
38/38 [==============================] - 5s 130ms/step - loss: 0.0010
Epoch 174/250
38/38 [==============================] - 6s 154ms/step - loss: 8.7857e-04
Epoch 175/250
38/38 [==============================] - 6s 146ms/step - loss: 9.9031e-04
Epoch 176/250
38/38 [==============================] - 5s 132ms/step - loss: 0.0010
Epoch 177/250
38/38 [==============================] - 6s 146ms/step - loss: 9.6927e-04
Epoch 178/250
38/38 [==============================] - 6s 150ms/step - loss: 9.5806e-04
Epoch 179/250
38/38 [==============================] - 5s 133ms/step - loss: 0.0010
Epoch 180/250
38/38 [==============================] - 6s 149ms/step - loss: 8.8994e-04
Epoch 181/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0010
Epoch 182/250
38/38 [==============================] - 5s 133ms/step - loss: 0.0011
Epoch 183/250
```

```
38/38 [==============================] - 6s 150ms/step - loss: 9.4733e-04
Epoch 184/250
38/38 [==============================] - 6s 147ms/step - loss: 0.0011
Epoch 185/250
38/38 [==============================] - 5s 129ms/step - loss: 0.0011
Epoch 186/250
38/38 [==============================] - 6s 146ms/step - loss: 0.0010
Epoch 187/250
38/38 [==============================] - 6s 150ms/step - loss: 9.5920e-04
Epoch 188/250
38/38 [==============================] - 5s 133ms/step - loss: 9.6178e-04
Epoch 189/250
38/38 [==============================] - 6s 151ms/step - loss: 0.0010
Epoch 190/250
38/38 [==============================] - 6s 151ms/step - loss: 0.0011
Epoch 191/250
38/38 [==============================] - 5s 135ms/step - loss: 9.1960e-04
Epoch 192/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0011
Epoch 193/250
38/38 [==============================] - 5s 144ms/step - loss: 9.3426e-04
Epoch 194/250
38/38 [==============================] - 5s 145ms/step - loss: 9.0672e-04
Epoch 195/250
38/38 [==============================] - 6s 150ms/step - loss: 9.8969e-04
Epoch 196/250
38/38 [==============================] - 5s 140ms/step - loss: 9.2938e-04
Epoch 197/250
38/38 [==============================] - 5s 140ms/step - loss: 9.2980e-04
Epoch 198/250
38/38 [==============================] - 6s 149ms/step - loss: 9.1129e-04
Epoch 199/250
38/38 [==============================] - 5s 136ms/step - loss: 9.4370e-04
Epoch 200/250
38/38 [==============================] - 5s 141ms/step - loss: 9.9796e-04
Epoch 201/250
38/38 [==============================] - 6s 154ms/step - loss: 0.0010
Epoch 202/250
38/38 [==============================] - 5s 139ms/step - loss: 0.0012
Epoch 203/250
38/38 [==============================] - 6s 154ms/step - loss: 0.0010
Epoch 204/250
38/38 [==============================] - 5s 129ms/step - loss: 9.9359e-04
Epoch 205/250
38/38 [==============================] - 5s 138ms/step - loss: 0.0011
Epoch 206/250
38/38 [==============================] - 6s 154ms/step - loss: 9.5648e-04
Epoch 207/250
38/38 [==============================] - 6s 155ms/step - loss: 0.0011
Epoch 208/250
38/38 [==============================] - 5s 142ms/step - loss: 0.0010
Epoch 209/250
38/38 [==============================] - 6s 150ms/step - loss: 0.0010
Epoch 210/250
38/38 [==============================] - 5s 139ms/step - loss: 9.6151e-04
Epoch 211/250
38/38 [==============================] - 5s 137ms/step - loss: 9.0391e-04
Epoch 212/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0010
Epoch 213/250
38/38 [==============================] - 6s 149ms/step - loss: 9.4700e-04
Epoch 214/250
38/38 [==============================] - 5s 130ms/step - loss: 9.6069e-04
```

```
Epoch 215/250
38/38 [==============================] - 6s 151ms/step - loss: 0.0012
Epoch 216/250
38/38 [==============================] - 6s 149ms/step - loss: 9.2598e-04
Epoch 217/250
38/38 [==============================] - 5s 133ms/step - loss: 9.7451e-04
Epoch 218/250
38/38 [==============================] - 6s 145ms/step - loss: 9.7341e-04
Epoch 219/250
38/38 [==============================] - 6s 149ms/step - loss: 9.6572e-04
Epoch 220/250
38/38 [==============================] - 5s 131ms/step - loss: 9.8095e-04
Epoch 221/250
38/38 [==============================] - 6s 153ms/step - loss: 8.7400e-04
Epoch 222/250
38/38 [==============================] - 5s 145ms/step - loss: 0.0011
Epoch 223/250
38/38 [==============================] - 5s 137ms/step - loss: 0.0011
Epoch 224/250
38/38 [==============================] - 5s 136ms/step - loss: 9.1128e-04
Epoch 225/250
38/38 [==============================] - 6s 151ms/step - loss: 9.6226e-04
Epoch 226/250
38/38 [==============================] - 5s 137ms/step - loss: 0.0011
Epoch 227/250
38/38 [==============================] - 6s 151ms/step - loss: 0.0011
Epoch 228/250
38/38 [==============================] - 6s 152ms/step - loss: 9.9489e-04
Epoch 229/250
38/38 [==============================] - 5s 134ms/step - loss: 9.9613e-04
Epoch 230/250
38/38 [==============================] - 6s 151ms/step - loss: 0.0012
Epoch 231/250
38/38 [==============================] - 6s 145ms/step - loss: 8.8872e-04
Epoch 232/250
38/38 [==============================] - 5s 139ms/step - loss: 9.2453e-04
Epoch 233/250
38/38 [==============================] - 5s 133ms/step - loss: 9.4380e-04
Epoch 234/250
38/38 [==============================] - 6s 146ms/step - loss: 9.7277e-04
Epoch 235/250
38/38 [==============================] - 5s 138ms/step - loss: 9.9370e-04
Epoch 236/250
38/38 [==============================] - 6s 152ms/step - loss: 0.0011
Epoch 237/250
38/38 [==============================] - 5s 141ms/step - loss: 9.2497e-04
Epoch 238/250
38/38 [==============================] - 5s 136ms/step - loss: 9.1600e-04
Epoch 239/250
38/38 [==============================] - 6s 152ms/step - loss: 9.8241e-04
Epoch 240/250
38/38 [==============================] - 5s 141ms/step - loss: 8.9683e-04
Epoch 241/250
38/38 [==============================] - 5s 143ms/step - loss: 0.0011
Epoch 242/250
38/38 [==============================] - 6s 149ms/step - loss: 9.8495e-04
Epoch 243/250
38/38 [==============================] - 5s 138ms/step - loss: 9.4539e-04
Epoch 244/250
38/38 [==============================] - 5s 145ms/step - loss: 9.1624e-04
Epoch 245/250
38/38 [==============================] - 6s 152ms/step - loss: 9.4371e-04
Epoch 246/250
```

```
38/38 [==============================] - 5s 133ms/step - loss: 8.7329e-04
Epoch 247/250
38/38 [==============================] - 6s 146ms/step - loss: 9.0333e-04
Epoch 248/250
38/38 [==============================] - 6s 153ms/step - loss: 9.2621e-04
Epoch 249/250
38/38 [==============================] - 5s 129ms/step - loss: 0.0010
Epoch 250/250
```

Out[16]:
```
<keras.callbacks.History at 0x20128ac3e80>
```

In [17]:
```
regressor.save('model')
```

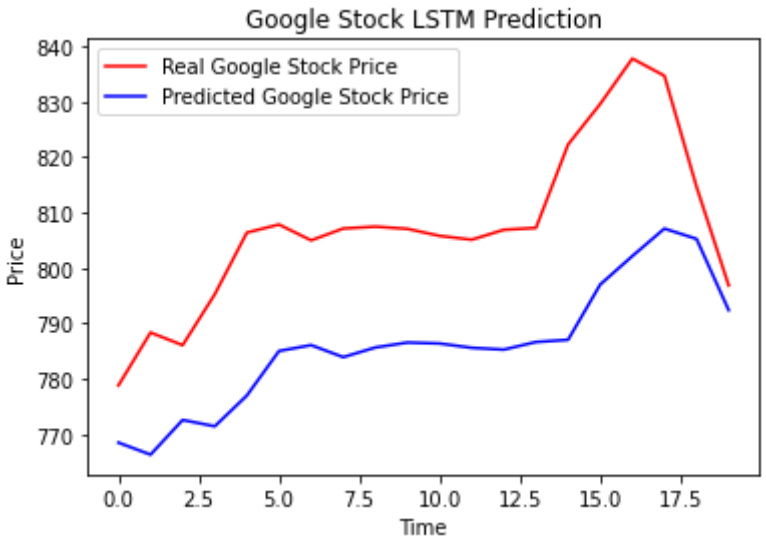
```
WARNING:absl:Found untraced functions such as lstm_cell_layer_call_fn, lstm
_cell_layer_call_and_return_conditional_losses, lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses, lstm_cell_2_layer_cal
l_fn while saving (showing 5 of 8). These functions will not be directly ca
llable after loading.
INFO:tensorflow:Assets written to: model\assets
INFO:tensorflow:Assets written to: model\assets
WARNING:absl:<keras.layers.recurrent.LSTMCell object at 0x0000020119F545B0>
has the same name 'LSTMCell' as a built-in Keras object. Consider renaming
<class 'keras.layers.recurrent.LSTMCell'> to avoid naming conflicts when lo
ading with `tf.keras.models.load_model`. If renaming is not possible, pass
the object in the `custom_objects` parameter of the load function.
WARNING:absl:<keras.layers.recurrent.LSTMCell object at 0x000002011B1F2640>
has the same name 'LSTMCell' as a built-in Keras object. Consider renaming
<class 'keras.layers.recurrent.LSTMCell'> to avoid naming conflicts when lo
ading with `tf.keras.models.load_model`. If renaming is not possible, pass
the object in the `custom_objects` parameter of the load function.
WARNING:absl:<keras.layers.recurrent.LSTMCell object at 0x0000020119F1DA90>
has the same name 'LSTMCell' as a built-in Keras object. Consider renaming
<class 'keras.layers.recurrent.LSTMCell'> to avoid naming conflicts when lo
ading with `tf.keras.models.load_model`. If renaming is not possible, pass
the object in the `custom_objects` parameter of the load function.
WARNING:absl:<keras.layers.recurrent.LSTMCell object at 0x000002011B343880>
has the same name 'LSTMCell' as a built-in Keras object. Consider renaming
<class 'keras.layers.recurrent.LSTMCell'> to avoid naming conflicts when lo
ading with `tf.keras.models.load_model`. If renaming is not possible, pass
the object in the `custom_objects` parameter of the load function.
```

In [18]:
```
# Importing testing set
dataset_test = pd.read_csv('Google_Stock_Price_Test.csv')
real_stock_set = dataset_test.iloc[:, 1:2].values
```

In [19]:
```
# Getting the predicted stock
dataset_total = pd.concat((dataset_train['Open'], dataset_test['Open']), ax
inputs = dataset_total[len(dataset_total) - len(dataset_test) - 60:].values
inputs = inputs.reshape(-1, 1)
inputs = sc.transform(inputs)

X_test = []
for i in range(60, 80):
    X_test.append(inputs[i-60:i, 0])
X_test = np.array(X_test)
X_test = np.reshape(X_test, (X_test.shape[0], X_test.shape[1], 1))

predicted_stock_set = regressor.predict(X_test)
predicted_stock_set = sc.inverse_transform(predicted_stock_set)
```

In [20]:

```
# visualizing
plt.plot(real_stock_set, color='red', label='Real Google Stock Price')
plt.plot(predicted_stock_set, color='blue', label='Predicted Google Stock P
plt.title('Google Stock LSTM Prediction')
plt.xlabel('Time')
plt.ylabel('Price')

plt.legend()
plt.show()
```



In [ ]: