In [4]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import LSTM,Dense,Dropout
from sklearn.preprocessing import MinMaxScaler
```

In [5]:
```
df=pd.read_csv("./airplane_passenger_prediction.csv")
```

In [6]:
```
df
```

Out[6]:

	Month	Passengers
0	1949-01	112
1	1949-02	118
2	1949-03	132
3	1949-04	129
4	1949-05	121
...	...	...
139	1960-08	606
140	1960-09	508
141	1960-10	461
142	1960-11	390
143	1960-12	432

144 rows × 2 columns

In [7]:
```
df["Month"]=pd.to_datetime(df["Month"])
df.set_index("Month",inplace=True)
df
```

Out[7]:

Month	Passengers
1949-01-01	112
1949-02-01	118
1949-03-01	132
1949-04-01	129
1949-05-01	121
...	...
1960-08-01	606
1960-09-01	508
1960-10-01	461
1960-11-01	390
1960-12-01	432

144 rows × 1 columns

In [8]:
```
scaler=MinMaxScaler(feature_range=(0,1))
```

In [9]:
```
data_scaled=scaler.fit_transform(df)
```

In [10]:
```
def create_sequence(data,seq_length):
  x,y=[],[]
  for i in range(len(data)-seq_length):
    x.append(data[i:(i+seq_length)])
    y.append(data[i+seq_length])
  return np.array(x),np.array(y)
```

In [11]:
```
seq_length=5
X,y=create_sequence(data_scaled,seq_length)
```

In [12]:
```
#split data into train-test split
size=int(0.8*len(X))
X_train,X_test=X[:size],X[size:]
y_train,y_test=y[:size],y[size:]
```

In [13]:
```
#Define the LSTM model
model=Sequential([LSTM(50,return_sequences=True,input_shape=(seq_length,1)),LSTM(50),Dense(1)])
```

In [14]:
```
model.compile(optimizer="adam",loss="mse")
model.fit(X_train,y_train,epochs=50,batch_size=16,verbose=1)
```

```
Epoch 1/50
7/7 [==============================] - 16s 12ms/step - loss: 0.0717
Epoch 2/50
7/7 [==============================] - 0s 16ms/step - loss: 0.0240
Epoch 3/50
7/7 [==============================] - 0s 19ms/step - loss: 0.0179
Epoch 4/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0144
Epoch 5/50
7/7 [==============================] - 0s 15ms/step - loss: 0.0118
Epoch 6/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0114
Epoch 7/50
7/7 [==============================] - 0s 13ms/step - loss: 0.0100
Epoch 8/50
7/7 [==============================] - 0s 18ms/step - loss: 0.0092
Epoch 9/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0089
Epoch 10/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0087
Epoch 11/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0087
Epoch 12/50
7/7 [==============================] - 0s 14ms/step - loss: 0.0087
Epoch 13/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0086
Epoch 14/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0086
Epoch 15/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0085
Epoch 16/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0084
Epoch 17/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0084
Epoch 18/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0083
Epoch 19/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0083
Epoch 20/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0083
Epoch 21/50
7/7 [==============================] - 0s 23ms/step - loss: 0.0084
Epoch 22/50
7/7 [==============================] - 0s 26ms/step - loss: 0.0084
Epoch 23/50
7/7 [==============================] - 0s 13ms/step - loss: 0.0081
Epoch 24/50
7/7 [==============================] - 0s 10ms/step - loss: 0.0086
Epoch 25/50
7/7 [==============================] - 0s 10ms/step - loss: 0.0082
Epoch 26/50
7/7 [==============================] - 0s 10ms/step - loss: 0.0081
Epoch 27/50
7/7 [==============================] - 0s 10ms/step - loss: 0.0080
Epoch 28/50
7/7 [==============================] - 0s 10ms/step - loss: 0.0079
Epoch 29/50
7/7 [==============================] - 0s 10ms/step - loss: 0.0082
Epoch 30/50
7/7 [==============================] - 1s 111ms/step - loss: 0.0076
Epoch 31/50
7/7 [==============================] - 0s 13ms/step - loss: 0.0077
Epoch 32/50
7/7 [==============================] - 0s 16ms/step - loss: 0.0076
Epoch 33/50
7/7 [==============================] - 0s 21ms/step - loss: 0.0075
Epoch 34/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0076
Epoch 35/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0076
Epoch 36/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0073
Epoch 37/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0077
Epoch 38/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0080
Epoch 39/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0074
Epoch 40/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0072
Epoch 41/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0070
Epoch 42/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0077
Epoch 43/50
7/7 [==============================] - 0s 14ms/step - loss: 0.0069
Epoch 44/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0070
Epoch 45/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0067
Epoch 46/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0067
Epoch 47/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0066
Epoch 48/50
7/7 [==============================] - 0s 12ms/step - loss: 0.0064
Epoch 49/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0065
Epoch 50/50
7/7 [==============================] - 0s 11ms/step - loss: 0.0063
<keras.callbacks.History at 0x26de47674c0>
```

Out[14]:

In [15]:
```
predictions=model.predict(X_test)
```

```
1/1 [==============================] - 3s 3s/step
```

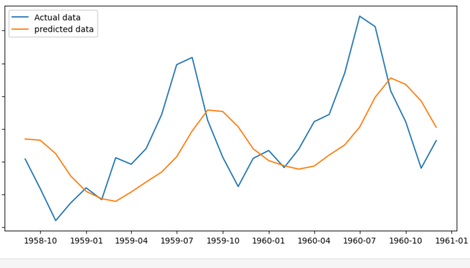
In [16]:
```
predictions=scaler.inverse_transform(predictions)
```

In [17]:
```
predictions
```

Out[17]:
```
array([[434.537 ],
       [432.76926],
       [412.17795],
       [378.1969 ],
       [354.6024 ],
       [343.441  ],
       [339.3838 ],
       [353.66962],
       [368.94315],
       [384.16858],
       [407.48694],
       [446.86337],
       [478.76862],
       [476.536  ],
       [453.2577 ],
       [419.64987],
       [401.6198 ],
       [393.82507],
       [388.5291 ],
       [393.27304],
       [410.07288],
       [425.4471 ],
       [452.74762],
       [498.32596],
       [527.7141 ],
       [517.89636],
       [492.57117],
       [452.51154]], dtype=float32)
```

In [18]:
```
y_test=scaler.inverse_transform(y_test)
```

In [20]:
```
plt.figure(figsize=(10,5))
plt.plot(df.index[-len(y_test):],y_test,label="Actual data")
plt.plot(df.index[-len(y_test):],predictions,label="predicted data")
plt.legend()
plt.show()
```



In [ ]:
```
```