In [1]:
```
import pandas as pd
```

In [4]:
```
data=pd.read_csv(r"/content/dataset1.csv")
```

In [5]:
```
data=data[["Wind Speed"]]
```

In [6]:
```
values=data.values
```

In [7]:
```
values
```

Out[7]:
```
array([[1.3],
       [1.2],
       [1.2],
       ...,
       [1.3],
       [1.3],
       [1.3]])
```

In [8]:
```
len(data)
```

Out[8]:
```
52560
```

In [9]:
```
#subtrcating last 3 values to make training and testing part
train=data.iloc[:52558]
test=data.iloc[-3:]
```

In [10]:
```
from sklearn.preprocessing import MinMaxScaler
```

In [11]:
```
scaler=MinMaxScaler()
```

In [12]:
```
scaler.fit(train)
scaled_train=scaler.transform(train)
scaled_test=scaler.transform(test)
```

In [13]:
```
scaled_train[:10]
```

Out[13]:
```
array([[0.14444444],
       [0.13333333],
       [0.13333333],
       [0.13333333],
       [0.13333333],
       [0.12222222],
       [0.12222222],
       [0.12222222],
       [0.12222222],
       [0.11111111]])
```

In [14]:
```
scaled_test
```

Out[14]:
```
array([[0.14444444],
       [0.14444444],
       [0.14444444]])
```

In [14]:
```

```

Data Preprocessing

In [15]:
```
import numpy as np
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import LSTM
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import Flatten
```

Preparing input and output features

In [16]:
```
from keras.preprocessing.sequence import TimeseriesGenerator
```

In [17]:
```
n_input=3
n_features=1
generator=TimeseriesGenerator(scaled_train,scaled_train,length=n_input,batch_s
```

In [18]:
```
X,y=generator[0]
```

In [19]:
```
#Given the array of this 3 array
X.flatten()
```

Out[19]:
```
array([0.14444444, 0.13333333, 0.13333333])
```

In [20]:
```
#predict this y
y
```

Out[20]:
```
array([[0.13333333]])
```

In [21]:
```
X.shape
```

Out[21]:
```
(1, 3, 1)
```

In [22]:
```
model=Sequential()
model.add(LSTM(100,activation="relu",input_shape=(n_input,n_features)))
model.add(Dense(1))
model.compile(optimizer="adam",loss="mse")
```

In [23]:
```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm (LSTM)                 (None, 100)               40800

 dense (Dense)               (None, 1)                 101

=================================================================
Total params: 40901 (159.77 KB)
Trainable params: 40901 (159.77 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

In [24]:
```
model.fit(generator,epochs=50)
```

```
Epoch 1/50
52555/52555 [==============================] - 239s 5ms/step - loss: 1.8967e-
04
Epoch 2/50
52555/52555 [==============================] - 236s 4ms/step - loss: 6.4026e-
05
Epoch 3/50
52555/52555 [==============================] - 239s 5ms/step - loss: 5.9110e-
05
Epoch 4/50
52555/52555 [==============================] - 239s 5ms/step - loss: 5.7445e-
05
Epoch 5/50
52555/52555 [==============================] - 236s 4ms/step - loss: 5.6268e-
05
Epoch 6/50
52555/52555 [==============================] - 235s 4ms/step - loss: 5.5119e-
05
Epoch 7/50
52555/52555 [==============================] - 238s 5ms/step - loss: 5.4740e-
05
Epoch 8/50
52555/52555 [==============================] - 239s 5ms/step - loss: 5.3981e-
05
Epoch 9/50
52555/52555 [==============================] - 236s 4ms/step - loss: 5.3522e-
05
Epoch 10/50
52555/52555 [==============================] - 233s 4ms/step - loss: 5.3142e-
05
Epoch 11/50
52555/52555 [==============================] - 230s 4ms/step - loss: 5.2704e-
05
Epoch 12/50
52555/52555 [==============================] - 234s 4ms/step - loss: 5.2374e-
05
Epoch 13/50
52555/52555 [==============================] - 232s 4ms/step - loss: 5.1892e-
05
Epoch 14/50
52555/52555 [==============================] - 235s 4ms/step - loss: 5.1733e-
05
Epoch 15/50
52555/52555 [==============================] - 238s 5ms/step - loss: 5.1457e-
05
Epoch 16/50
52555/52555 [==============================] - 247s 5ms/step - loss: 5.1313e-
05
Epoch 17/50
52555/52555 [==============================] - 247s 5ms/step - loss: 5.1137e-
05
Epoch 18/50
52555/52555 [==============================] - 234s 4ms/step - loss: 5.1218e-
05
Epoch 19/50
52555/52555 [==============================] - 240s 5ms/step - loss: 5.0993e-
05
```

```
Epoch 20/50
52555/52555 [==============================] - 244s 5ms/step - loss: 5.0556e-
05
Epoch 21/50
52555/52555 [==============================] - 248s 5ms/step - loss: 5.0789e-
05
Epoch 22/50
52555/52555 [==============================] - 253s 5ms/step - loss: 5.0321e-
05
Epoch 23/50
52555/52555 [==============================] - 251s 5ms/step - loss: 5.0451e-
05
Epoch 24/50
52555/52555 [==============================] - 267s 5ms/step - loss: 5.0384e-
05
Epoch 25/50
52555/52555 [==============================] - 268s 5ms/step - loss: 5.0644e-
05
Epoch 26/50
52555/52555 [==============================] - 248s 5ms/step - loss: 5.0457e-
05
Epoch 27/50
52555/52555 [==============================] - 246s 5ms/step - loss: 5.0217e-
05
Epoch 28/50
52555/52555 [==============================] - 249s 5ms/step - loss: 5.0306e-
05
Epoch 29/50
52555/52555 [==============================] - 250s 5ms/step - loss: 4.9806e-
05
Epoch 30/50
52555/52555 [==============================] - 247s 5ms/step - loss: 5.0090e-
05
Epoch 31/50
52555/52555 [==============================] - 245s 5ms/step - loss: 5.0066e-
05
Epoch 32/50
52555/52555 [==============================] - 239s 5ms/step - loss: 4.9698e-
05
Epoch 33/50
52555/52555 [==============================] - 241s 5ms/step - loss: 4.9869e-
05
Epoch 34/50
52555/52555 [==============================] - 244s 5ms/step - loss: 4.9696e-
05
Epoch 35/50
52555/52555 [==============================] - 242s 5ms/step - loss: 4.9493e-
05
Epoch 36/50
52555/52555 [==============================] - 243s 5ms/step - loss: 4.9445e-
05
Epoch 37/50
52555/52555 [==============================] - 242s 5ms/step - loss: 4.9443e-
05
Epoch 38/50
52555/52555 [==============================] - 244s 5ms/step - loss: 4.9353e-
05
```

```
Epoch 39/50
52555/52555 [==============================] - 248s 5ms/step - loss: 4.9421e-
05
Epoch 40/50
52555/52555 [==============================] - 242s 5ms/step - loss: 4.9426e-
05
Epoch 41/50
52555/52555 [==============================] - 239s 5ms/step - loss: 4.9478e-
05
Epoch 42/50
52555/52555 [==============================] - 241s 5ms/step - loss: 4.9197e-
05
Epoch 43/50
52555/52555 [==============================] - 242s 5ms/step - loss: 4.9189e-
05
Epoch 44/50
52555/52555 [==============================] - 241s 5ms/step - loss: 4.9007e-
05
Epoch 45/50
52555/52555 [==============================] - 251s 5ms/step - loss: 4.9029e-
05
Epoch 46/50
52555/52555 [==============================] - 237s 5ms/step - loss: 4.9099e-
05
Epoch 47/50
52555/52555 [==============================] - 240s 5ms/step - loss: 4.9016e-
05
Epoch 48/50
52555/52555 [==============================] - 237s 5ms/step - loss: 4.9086e-
05
Epoch 49/50
52555/52555 [==============================] - 246s 5ms/step - loss: 4.9054e-
05
Epoch 50/50
52555/52555 [==============================] - 243s 5ms/step - loss: 4.8854e-
05
```

Out[24]: <keras.src.callbacks.History at 0x7c514885d6c0>

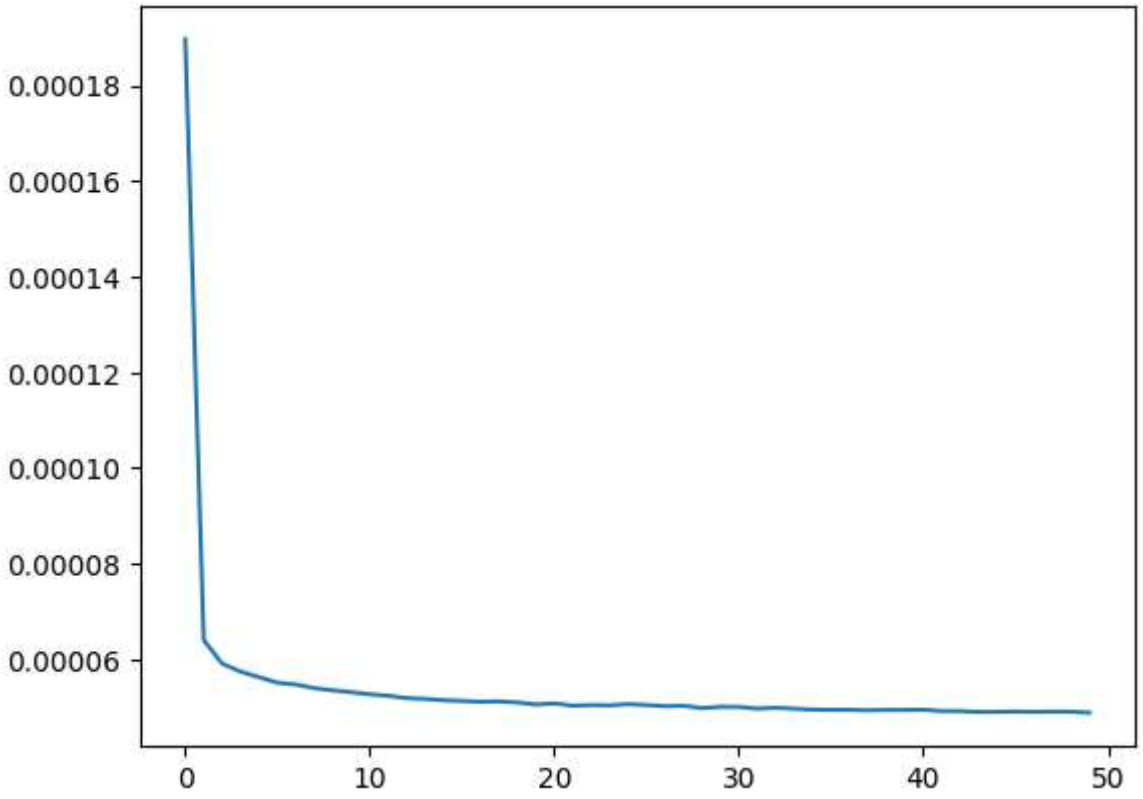
In [27]:
```
loss_per_epoch = model.history.history["loss"]
```

In [28]:
```
loss_per_epoch
```

Out[28]:
```
[0.00018966513744089752,
 6.40259386273101e-05,
 5.910962863708846e-05,
 5.744459485867992e-05,
 5.6267530453624204e-05,
 5.511860945262015e-05,
 5.473979763337411e-05,
 5.3980707889422774e-05,
 5.3521765948971733e-05,
 5.3142051910981536e-05,
 5.270391557132825e-05,
 5.237376899458468e-05,
 5.189164585317485e-05,
 5.1733411964960396e-05,
 5.145712930243462e-05,
 5.131294165039435e-05,
 5.113660517963581e-05,
 5.121847061673179e-05,
 5.099286136101e-05,
 5.055598376202397e-05,
 5.078916365164332e-05,
 5.032082481193356e-05,
 5.045071884524077e-05,
 5.038386007072404e-05,
 5.0644335715333e-05,
 5.045735451858491e-05,
 5.0216673116665334e-05,
 5.030607644584961e-05,
 4.980624362360686e-05,
 5.008964581065811e-05,
 5.0066490075550973e-05,
 4.9698312068358064e-05,
 4.986941712559201e-05,
 4.969593646819703e-05,
 4.949349749949761e-05,
 4.944543616147712e-05,
 4.944348256685771e-05,
 4.9352685891790316e-05,
 4.9421123549109325e-05,
 4.942579471389763e-05,
 4.9477865104563534e-05,
 4.919696948491037e-05,
 4.918938429909758e-05,
 4.900711792288348e-05,
 4.9028541980078444e-05,
 4.909892231808044e-05,
 4.901634747511707e-05,
 4.908601476927288e-05,
 4.905352398054674e-05,
 4.8854377382667735e-05]
```

In [30]:
```
import matplotlib.pyplot as plt
plt.plot(range(len(loss_per_epoch)),loss_per_epoch)
```

Out[30]:
```
[<matplotlib.lines.Line2D at 0x7c5137ef0be0>]
```



In [39]:
```
#loss has been decreasing
#last 3 value
last_train_batch=scaled_train[-3:]
```

In [40]:
```
last_train_batch
```

Out[40]:
```
array([[0.14444444],
       [0.14444444],
       [0.14444444]])
```

In [41]:
```
last_train_batch=last_train_batch.reshape((1,n_input,n_features))
```

In [42]:
```
last_train_batch
```

Out[42]:
```
array([[[0.14444444],
        [0.14444444],
        [0.14444444]]])
```

In [44]:
```
model.predict(last_train_batch)
```

```
1/1 [==============================] - 0s 469ms/step
```

Out[44]:
```
array([[0.14522937]], dtype=float32)
```

In [45]:
```
scaled_test[0]
```

Out[45]:
```
array([0.14444444])
```

In [47]:
```
#actual is 0.1444 and model prediction is 0.1452
```

In [49]:
```
tes_predictions=[]
first_eval_batch=scaled_train[-n_input:]
current_batch=first_eval_batch.reshape((1,n_input,n_features))

for i in range(len(test)):
  #get the prediction value for first batch
  current_pred=model.predict(current_batch)[0]

  #append the predictions into the array
  tes_predictions.append(current_pred)

  #use the prediction to update the batch and remove the first value
  current_batch=np.append(current_batch[:,1:,:],[[current_pred]],axis=1)
```

```
1/1 [==============================] - 0s 52ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 38ms/step
```

In [50]:
```
tes_predictions
```

Out[50]:
```
[array([0.14522937], dtype=float32),
 array([0.14622922], dtype=float32),
 array([0.14755736], dtype=float32)]
```

In [51]:
```
current_batch
```

Out[51]:
```
array([[[0.14522937],
        [0.14622922],
        [0.14755736]]])
```

In [52]:
```
current_pred
```

Out[52]:
```
array([0.14755736], dtype=float32)
```

In [53]:
```
#converting back into original scale
true_predictions=scaler.inverse_transform(tes_predictions)
```

In [54]:
```
true_predictions
```

Out[54]:
```
array([[1.30706432],
       [1.316063  ],
       [1.32801627]])
```

In [55]:
```
test["predictions"]=true_predictions
```

```
<ipython-input-55-28db28758c71>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  test["predictions"]=true_predictions
```

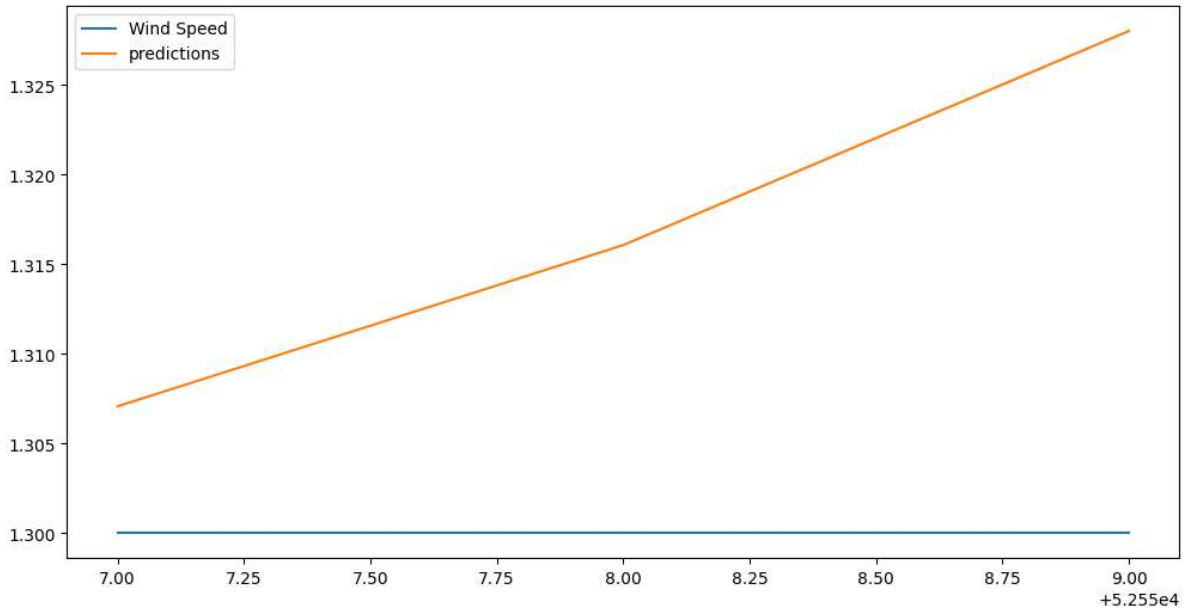
In [56]:
```
test
```

Out[56]:

	Wind Speed	predictions
52557	1.3	1.307064
52558	1.3	1.316063
52559	1.3	1.328016

In [57]:
```
test.plot(figsize=(12,6))
```

Out[57]: <Axes: >



In [58]:
```
from sklearn.metrics import mean_squared_error
from math import sqrt
rmse=sqrt(mean_squared_error(test["predictions"],test["Wind Speed"]))
```

In [59]:
```
rmse
```

Out[59]: 0.019086084641875452

In [ ]: