6. Develop a program to forecast future values in time series data, such as weather patterns, using RNN models like LSTM or GRU.

(Using Synthetic data)

In [2]:
```
import numpy as np
import tensorflow as tf
import matplotlib.pyplot as plt
```

In [3]:
```
data = np.sin(np.arange(100) * 0.1)
data.shape
```

Out[3]:
```
(100,)
```

In [4]:
```
X, y = [], []
for i in range(len(data) - 10):
    X.append(data[i:i+10])
    y.append(data[i+10])
```

In [5]:
```
X, y = np.array(X), np.array(y)
X = X.reshape(-1, 10, 1)
```

In [6]:
```
model = tf.keras.Sequential([
    tf.keras.layers.Input(shape=(10, 1)),
    tf.keras.layers.LSTM(20),
    tf.keras.layers.Dense(1)
])
```

In [7]:
```
model.compile(optimizer='adam', loss='mse')
```

In [8]:
```
model.fit(X, y, epochs=10, verbose=1)
```

```
Epoch 1/10
3/3 [==============================] - 1s 6ms/step - loss: 0.4648
Epoch 2/10
3/3 [==============================] - 0s 4ms/step - loss: 0.4124
Epoch 3/10
3/3 [==============================] - 0s 4ms/step - loss: 0.3590
Epoch 4/10
3/3 [==============================] - 0s 4ms/step - loss: 0.3142
Epoch 5/10
3/3 [==============================] - 0s 3ms/step - loss: 0.2756
Epoch 6/10
3/3 [==============================] - 0s 3ms/step - loss: 0.2407
Epoch 7/10
3/3 [==============================] - 0s 4ms/step - loss: 0.2106
Epoch 8/10
3/3 [==============================] - 0s 3ms/step - loss: 0.1876
Epoch 9/10
3/3 [==============================] - 0s 6ms/step - loss: 0.1692
Epoch 10/10
3/3 [==============================] - 0s 2ms/step - loss: 0.1547
```

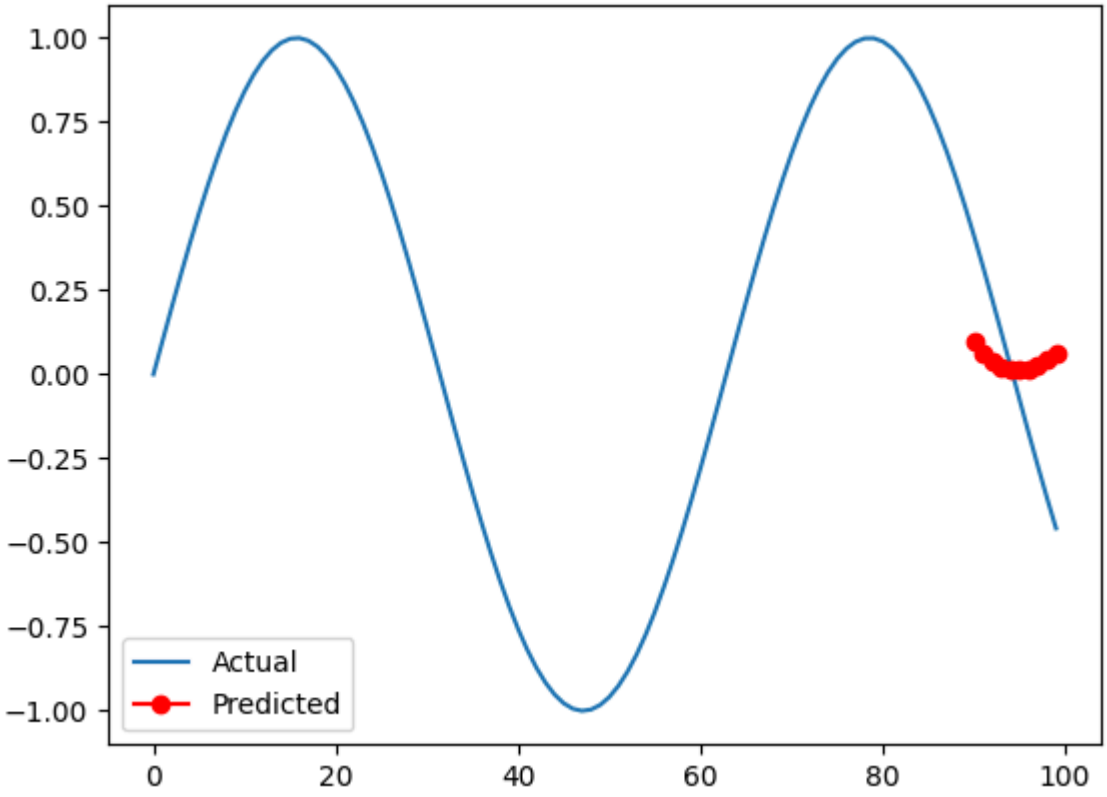
Out[8]:
```
<keras.callbacks.History at 0x2225eff6710>
```

In [9]:
```
preds = []
seq = X[-1]
```

In [10]:
```
for _ in range(10):
    pred = model.predict(seq.reshape(1, 10, 1), verbose=0)[0, 0]
```

```
    preds.append(pred)
    seq = np.roll(seq, -1) # shift sequence
    seq[-1] = pred # append predicted value
```

In [11]:
```
plt.plot(data, label='Actual')
plt.plot(range(90, 100), preds, 'ro-', label='Predicted')
plt.legend()
plt.show()
```



In [ ]: