2022년 IoT기반 스마트 솔루션 개발자 양성과정

Programming : Python

8-MatPlotLib

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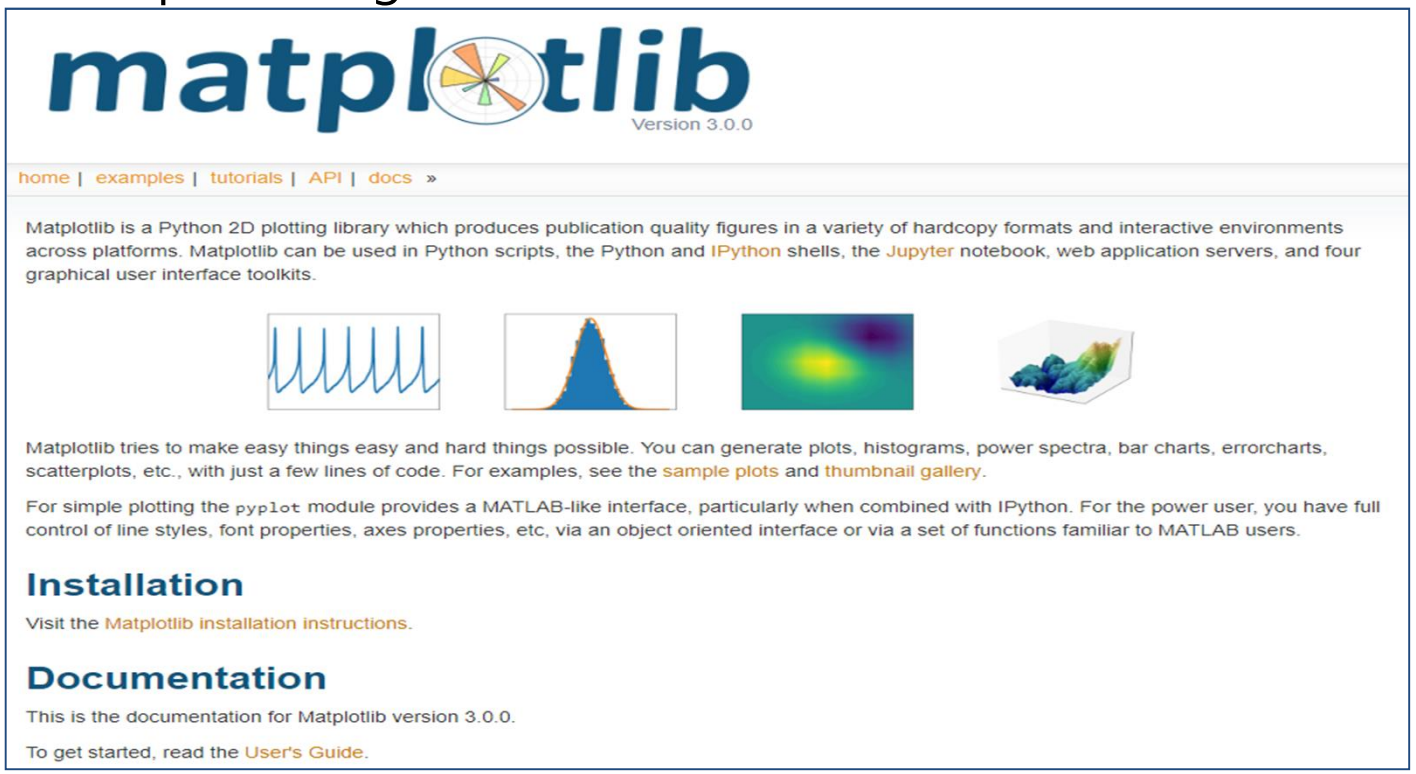
MatPlotLib

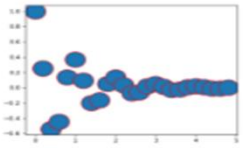
- 파이썬에서 자료를 차트(chart)나 플롯(plot)으로 시각화(visulaization)하는 패키지
  - 라인 플롯(line plot)
  - 스캐터 플롯(scatter plot)
  - 컨투어 플롯(contour plot)
  - 서피스 플롯(surface plot)
  - 바 차트(bar chart)
  - 히스토그램(histogram)
  - 박스 플롯(box plot)

MatPlotLib.org

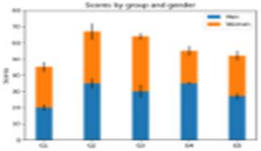
- https://matplotlib.org



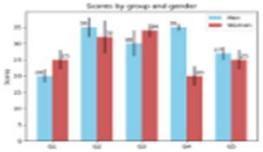
Gallery



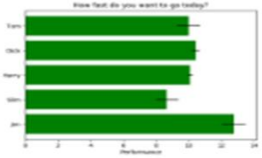
Arctest



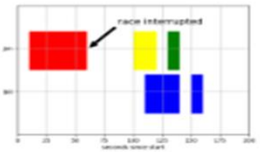
Stacked Bar Graph



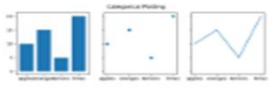
Barchart



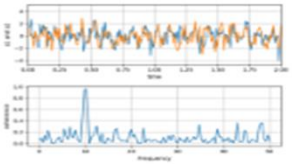
Horizontal bar chart



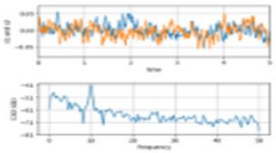
Broken Barh



Plotting categorical variables



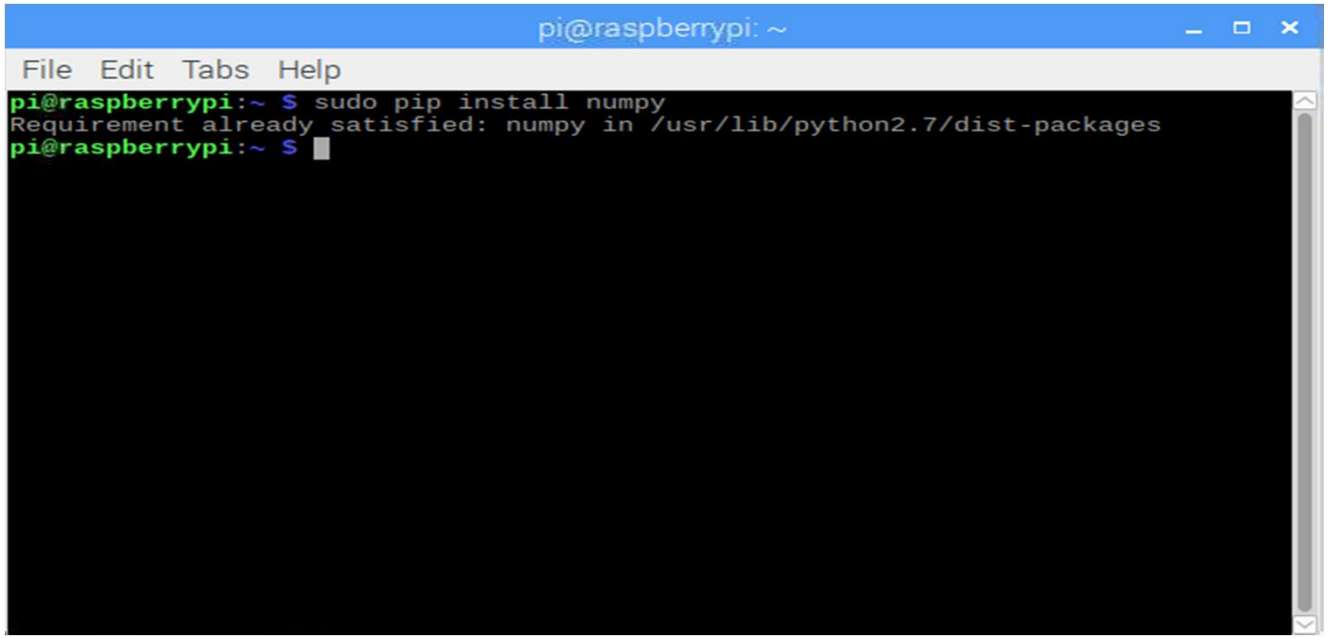
Plotting the coherence of two signals



CSD Demo

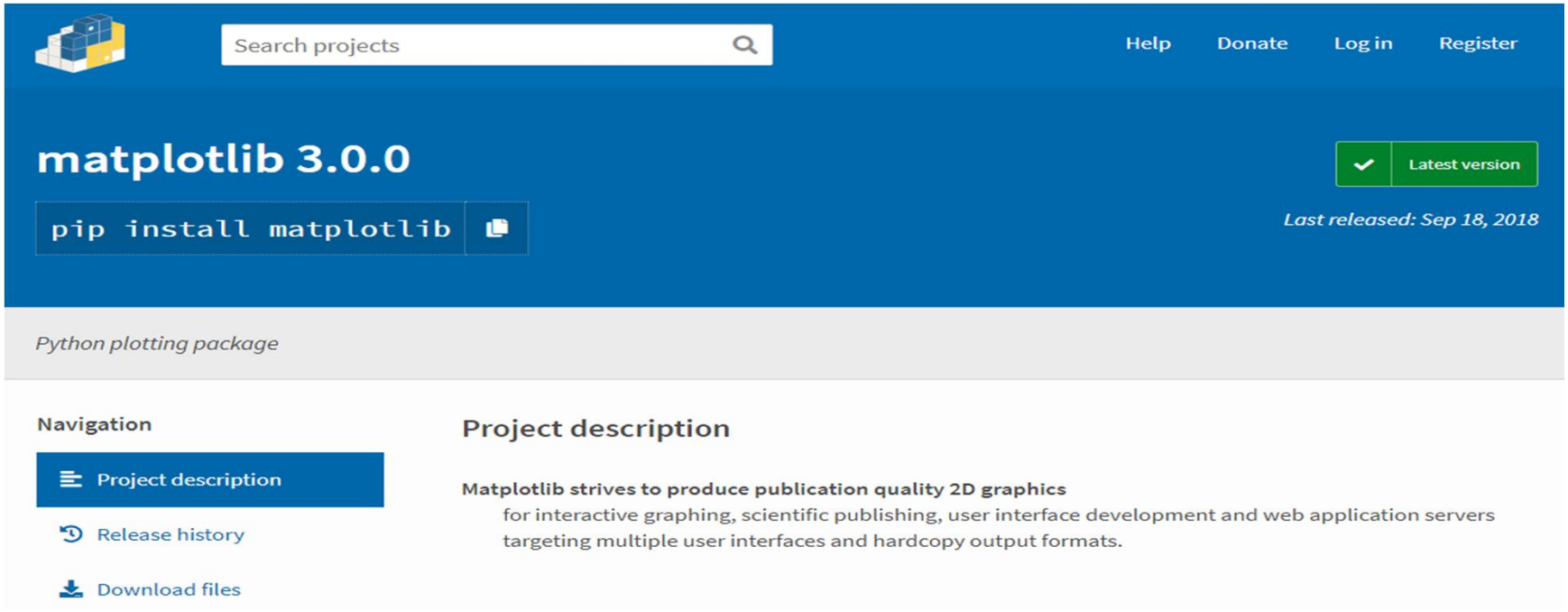
Install numpy

- $ sudo pip install numpy



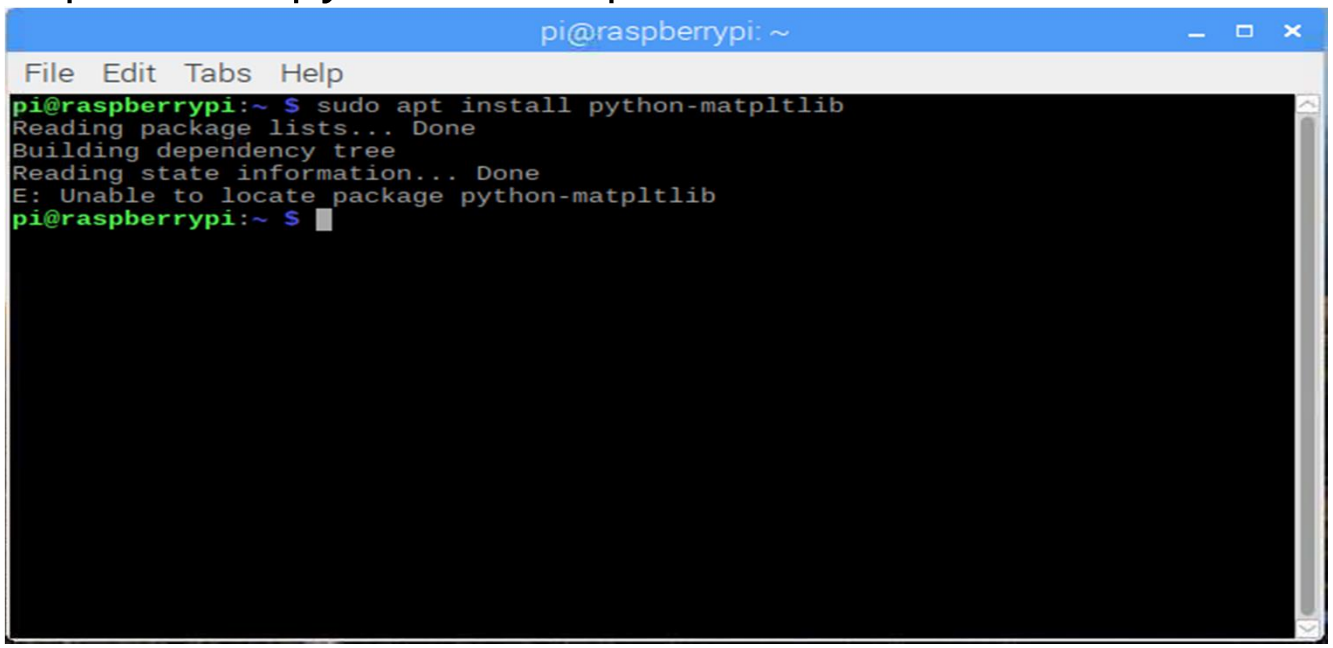
PIP install

- https://pypi.org

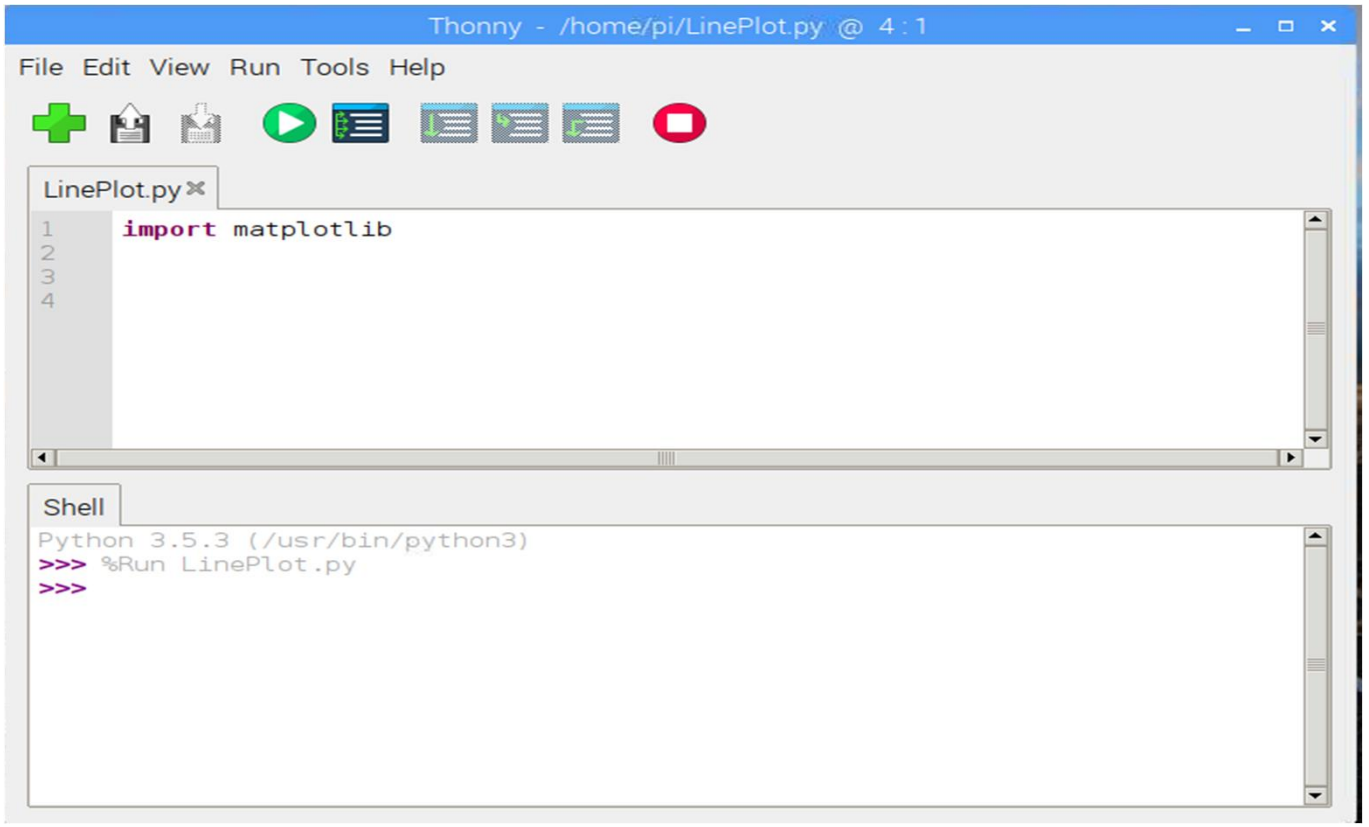


Install MatPltLib

- $ sudo apt install python3-matplotlib

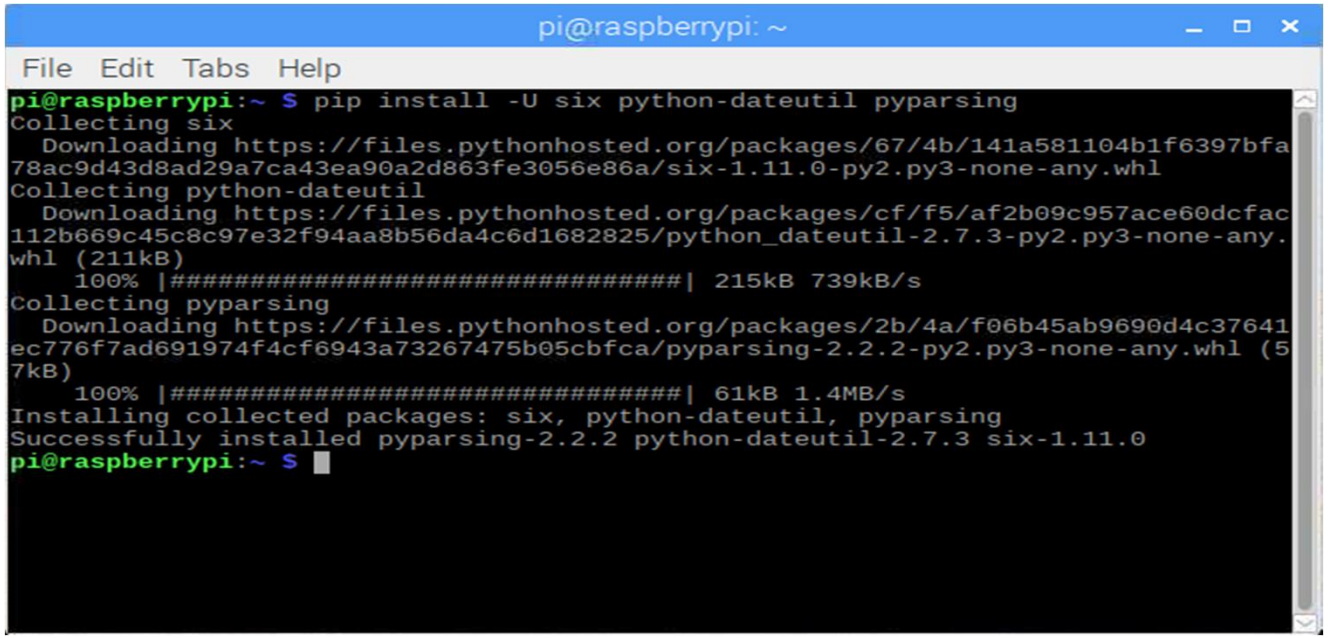


설치 확인


Thonny - /home/pi/LinePlot.py @ 4 : 1
File Edit View Run Tools Help
LinePlot.py
1 import matplotlib
2
3
4
Shell
Python 3.5.3 (/usr/bin/python3)
>>> %Run LinePlot.py
>>>

필수 util 설치

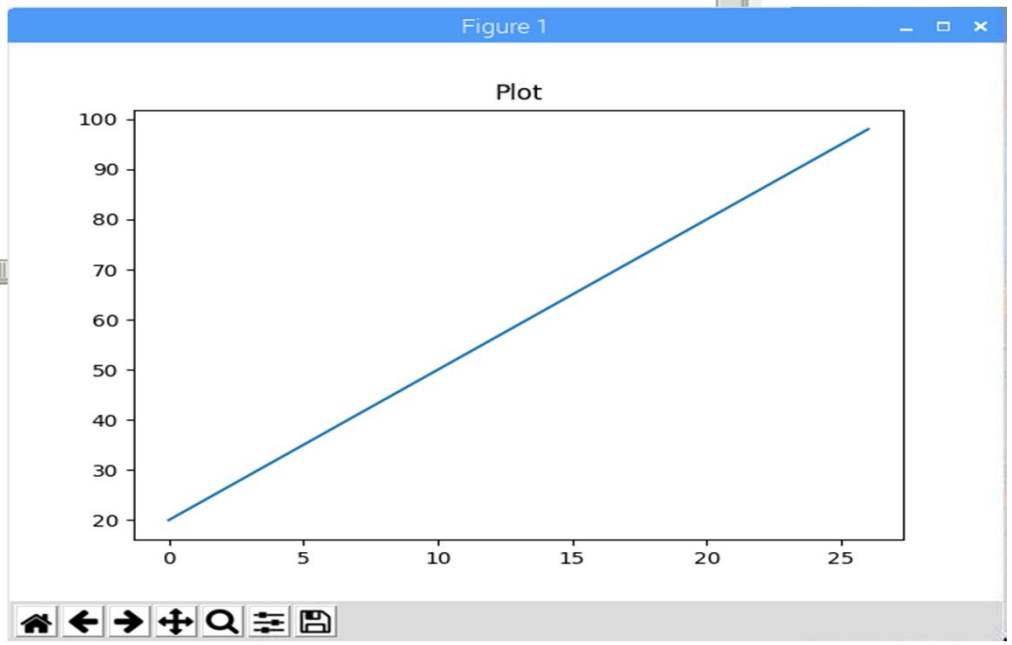
- $ sudo pip install –U six python-dateutil cycler pyparsing



Ex1 : Line Plot

LinePlot.py

```
1  import matplotlib as mpl
2  import matplotlib.pyplot as plt
3
4  plt.title("Plot")
5  y=[k for k in range(20,100,3)]
6  x=[k for k in range(len(y))]
7  plt.plot(x,y)
8  plt.show()
9
10
```

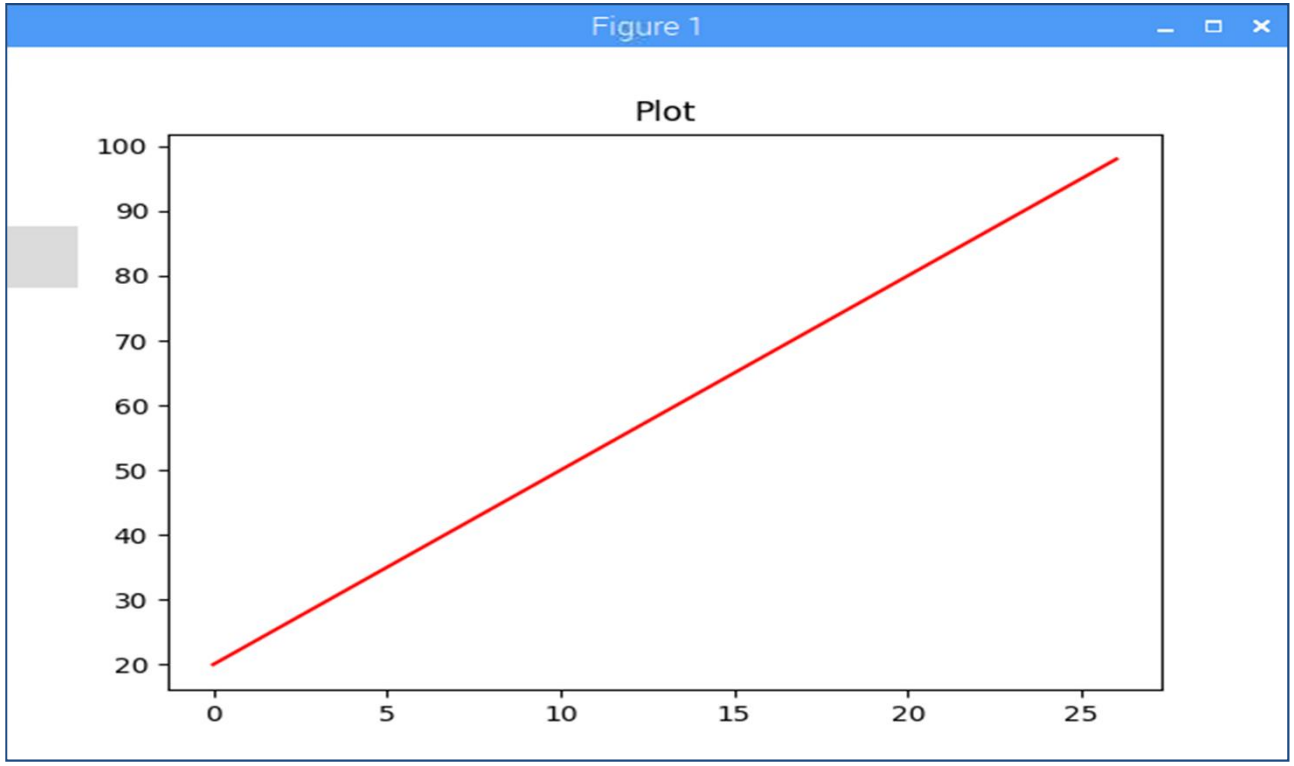


Ex2 : Line Color

LinePlot.py

```
1  import matplotlib as mpl
2  import matplotlib.pyplot as plt
3
4  plt.title("Plot")
5  y=[k for k in range(20,100,3)]
6  x=[k for k in range(len(y))]
7  plt.plot(x,y,'r')
8  plt.show()
9
10
```

Ex2 : Run



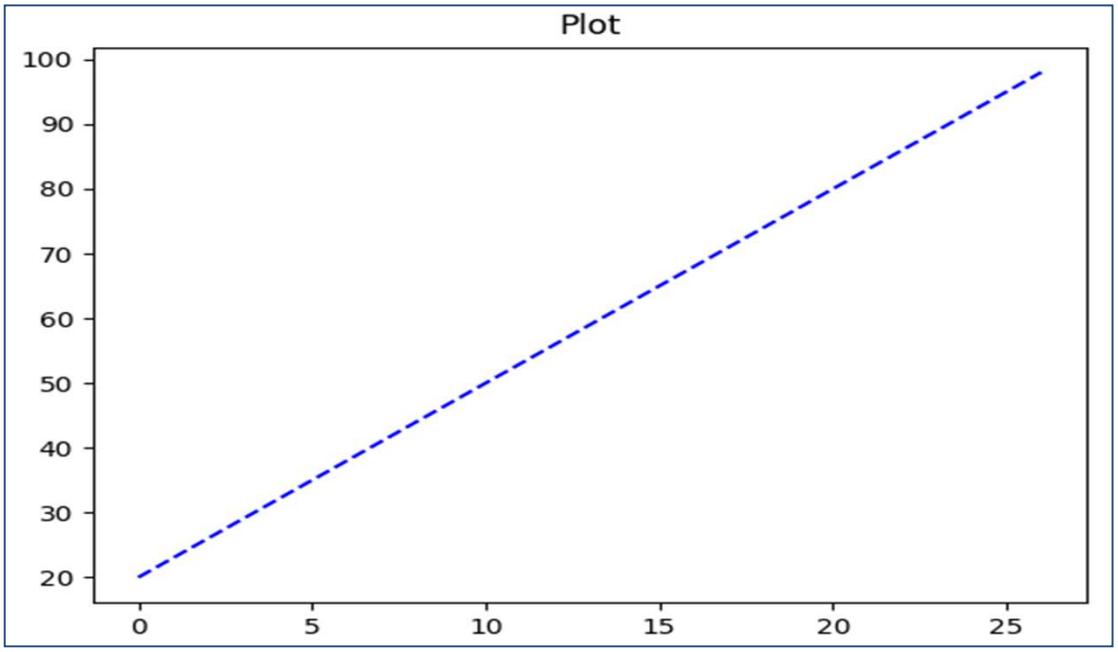
Char	Color
b	Blue
g	Green
r	Red
c	Cyan
m	Magenta
Y	Yellow
k	Black
w	White

Ex3 : Line Style

LinePlot.py *

```
1  import matplotlib as mpl
2  import matplotlib.pyplot as plt
3
4  plt.title("Plot")
5  y=[k for k in range(20,100,3)]
6  x=[k for k in range(len(y))]
7  plt.plot(x,y,'b--')
8  plt.show()
9
10
11
12
```

Ex3 : Run



Char	Style
-	Solid
--	Dashed
-.	Dash-dot
:	Dotted
.	Point

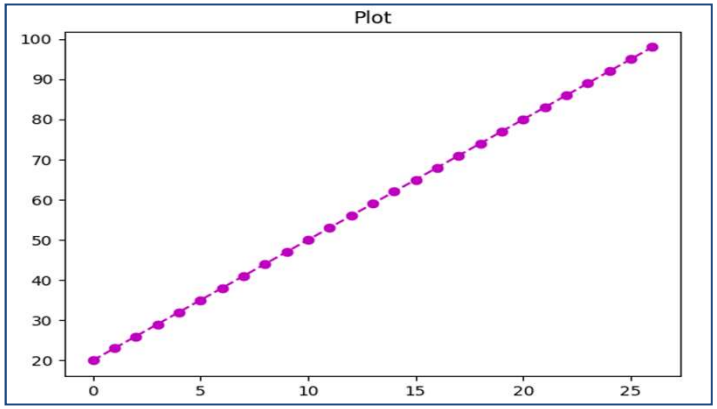
Ex4 : Marker

LinePlot.py

```
1   import matplotlib as mpl
2   import matplotlib.pyplot as plt
3
4   plt.title("Plot")
5   y=[k for k in range(20,100,3)]
6   x=[k for k in range(len(y))]
7   plt.plot(x,y,'m--o')
8   plt.show()
9
10
11
12
```

Ex4 : Run

Char	Style	Char	Style
.	Point	s	Square
,	Pixel	p	Pentagon
o	Circle	*	Star
v	Triangle-down	h	Hexagon1
^	Triangle-up	H	Hexagon2
<	Triangle-left	+	Plus
>	Triangle-right	x	X
1	Tri-down	D	Diamond
2	Tri-up	d	Thin-diamond
3	Tri-left	|	Vline
4	Tri-right	_	Hline

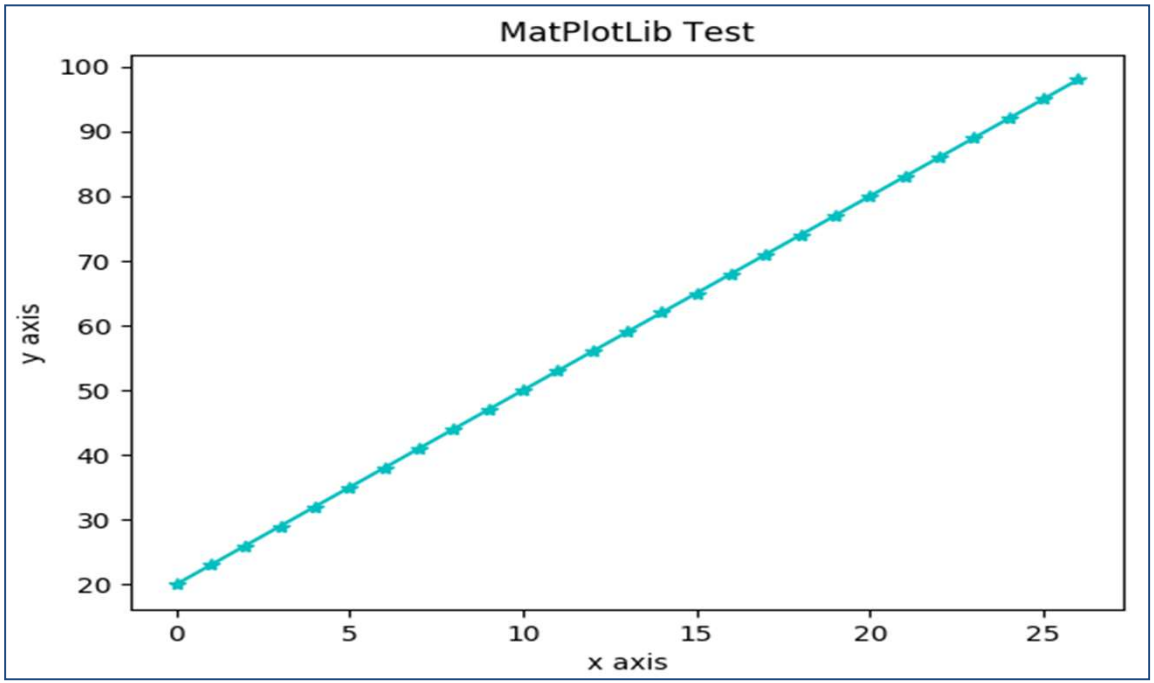


Ex5 : label & Title

LinePlot.py *

```
1   import matplotlib as mpl
2   import matplotlib.pyplot as plt
3
4   plt.title("Plot")
5   y=[k for k in range(20,100,3)]
6   x=[k for k in range(len(y))]
7   plt.plot(x,y,'c-*')
8   plt.xlabel('x axis')
9   plt.ylabel('y axis')
10  plt.title('MatPlotLib Test')
11  plt.show()
12
```

Ex5 : Run

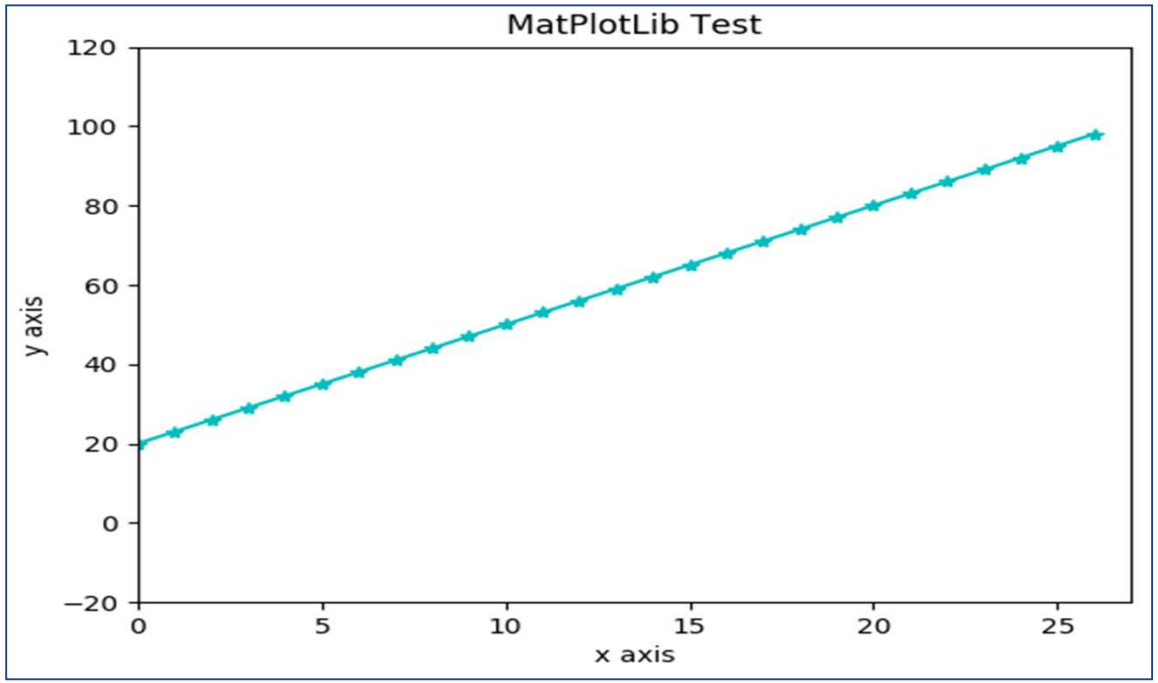

MatPlotLib Test
y axis
x axis
100
90
80
70
60
50
40
30
20
0
5
10
15
20
25

Ex6 : Plot Limit

LinePlot.py

```
1  import matplotlib as mpl
2  import matplotlib.pyplot as plt
3
4  plt.title("Plot")
5  y=[k for k in range(20,100,3)]
6  x=[k for k in range(len(y))]
7  plt.xlim(0,len(y))
8  plt.ylim(-20,120)
9  plt.plot(x,y,'c-*')
10 plt.xlabel('x axis')
11 plt.ylabel('y axis')
12 plt.title('MatPlotLib Test')
13 plt.show()
14
```

Ex6 : Run

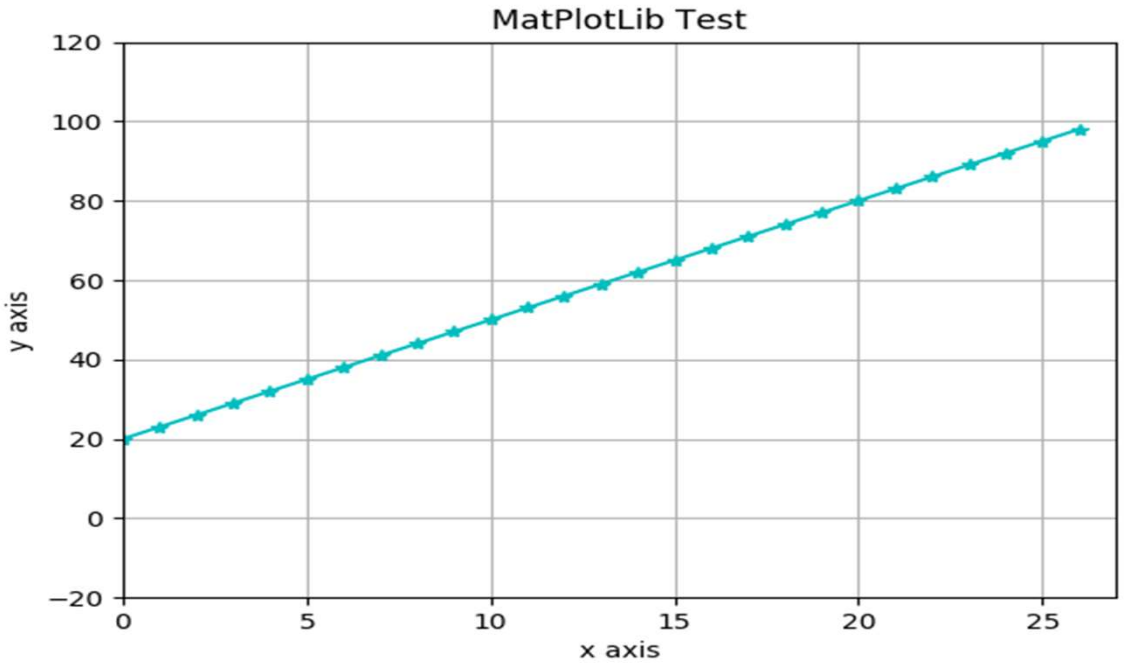

MatPlotLib Test
120
100
80
60
40
20
0
−20
y axis
0
5
10
15
20
25
x axis

Ex7 : Grid

LinePlot.py

```
1   import matplotlib as mpl
2   import matplotlib.pyplot as plt
3
4   plt.title("Plot")
5   y=[k for k in range(20,100,3)]
6   x=[k for k in range(len(y))]
7   plt.xlim(0,len(y))
8   plt.ylim(-20,120)
9   plt.plot(x,y,'c-*')
10  plt.xlabel('x axis')
11  plt.ylabel('y axis')
12  plt.title('MatPlotLib Test')
13  plt.grid(True)
14  plt.show()
15
```

Ex7 : Run

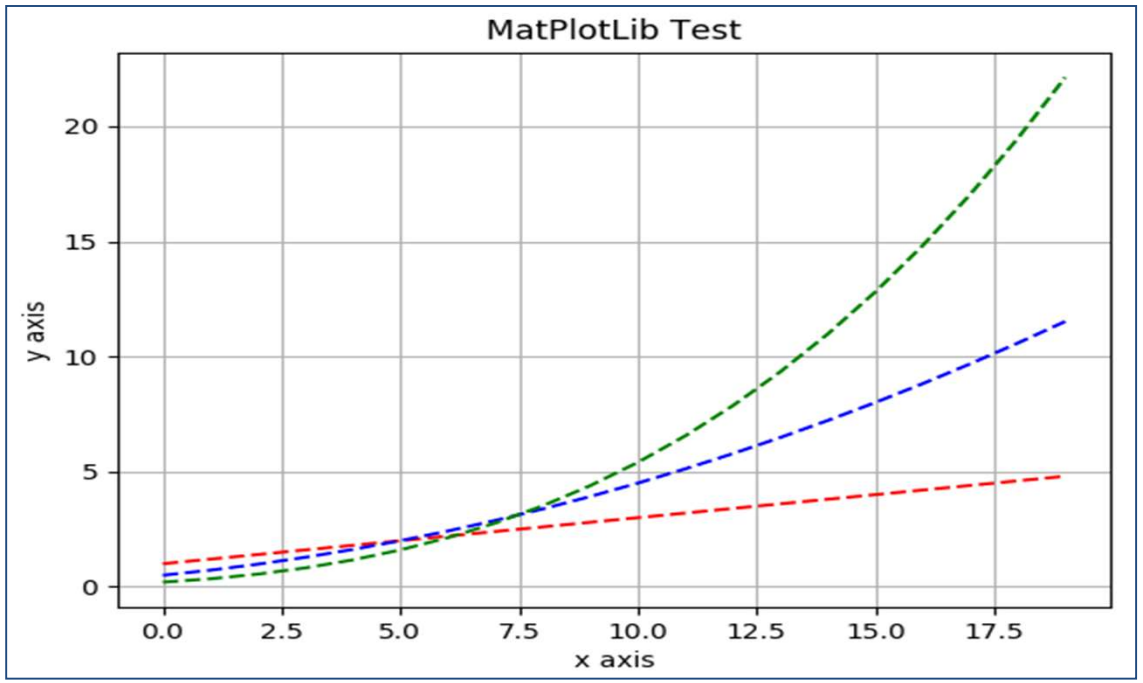

MatPlotLib Test
120
100
80
60
40
20
0
−20
y axis
0
5
10
15
20
25
x axis

Ex8 : Multi Line

LinePlot2.py

```
1   import matplotlib as mpl
2   import matplotlib.pyplot as plt
3   import numpy
4
5   plt.title('MatPlotLib Test')
6   plt.xlabel('x axis')
7   plt.ylabel('y axis')
8
9   y1=numpy.arange(1.0,5.0,0.2)
10  x=[k for k in range(len(y1))]
11  plt.plot(x,y1,'r--',
12           x,0.5*y1**2,'b--',
13           x,0.2*y1**3,'g--')
14  plt.grid(True)
15  plt.show()
```

Ex8 : Run

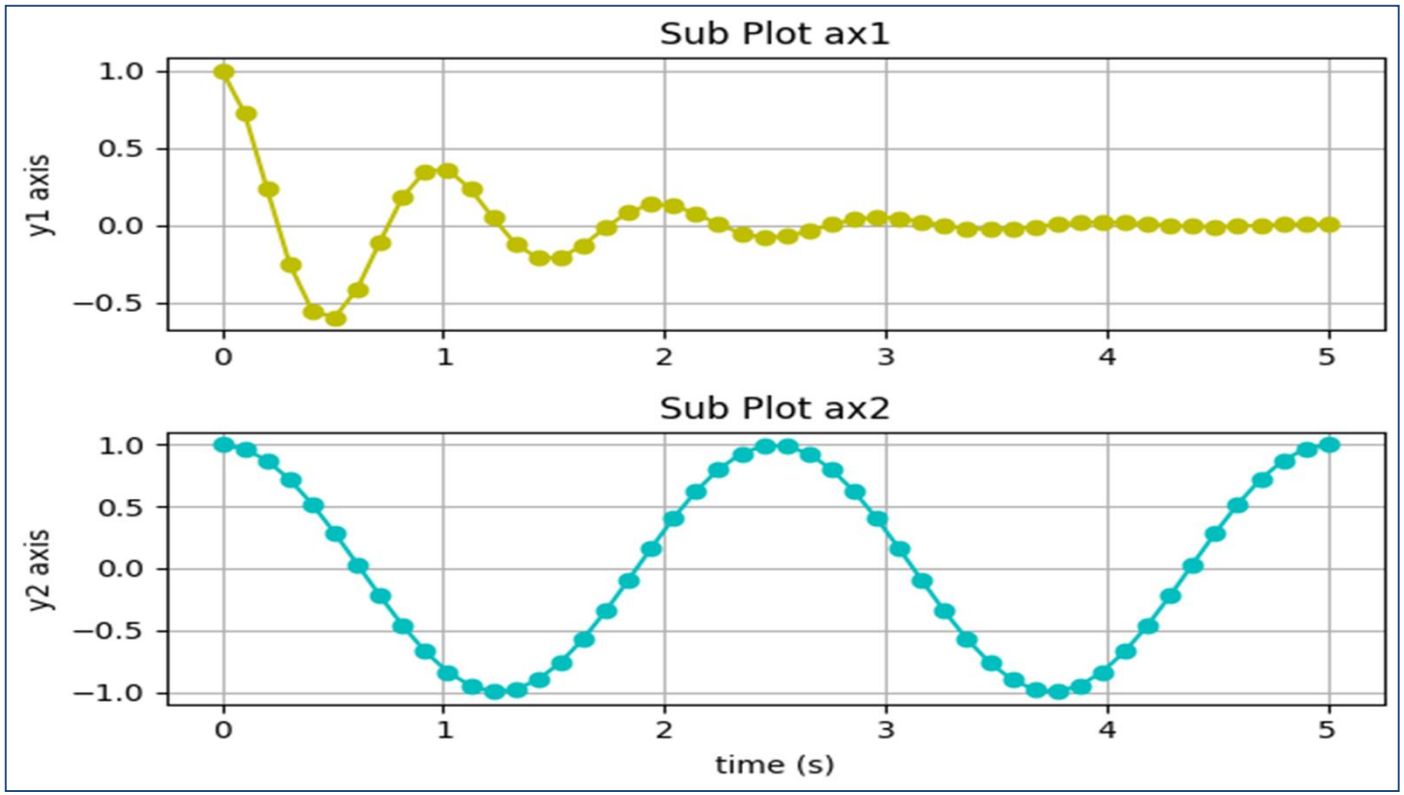

MatPlotLib Test
y axis
x axis
0
5
10
15
20
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5

Ex9 : Sub Plot

SubPlot.py *

```
1   import matplotlib.pyplot as plt
2   import numpy as np
3
4   x1=np.linspace(0.0, 5.0)
5   x2=np.linspace(0.0, 2.0)
6   y1=np.cos(2 * np.pi * x1) * np.exp(-x1)
7   y2=np.cos(2 * np.pi * x2)
8
9   ax1=plt.subplot(2,1,1)
10  plt.plot(x1,y1,'yo-')
11  plt.title('Sub Plot ax1')
12  plt.ylabel('y1 axis')
13  plt.grid(True)
14  print(ax1)
15
16  ax2=plt.subplot(2,1,2)
17  plt.plot(x1,y2,'co-')
18  plt.title('Sub Plot ax2')
19  plt.ylabel('y2 axis')
20  plt.xlabel('time (s)')
21  plt.grid(True)
22  print(ax2)
23
24  plt.tight_layout()
25  plt.show()
26
```

Ex9 : Run

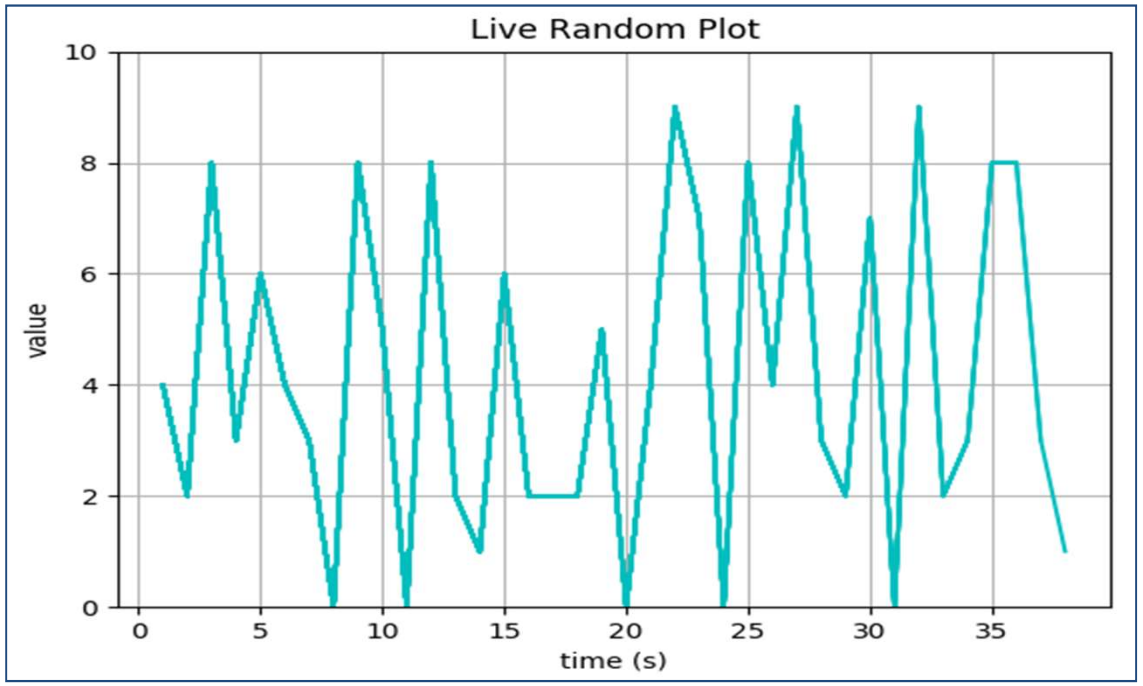

Sub Plot ax1
y1 axis
1.0
0.5
0.0
−0.5
0
1
2
3
4
5
Sub Plot ax2
y2 axis
1.0
0.5
0.0
−0.5
−1.0
0
1
2
3
4
5
time (s)

Ex10 : Live Random Plot

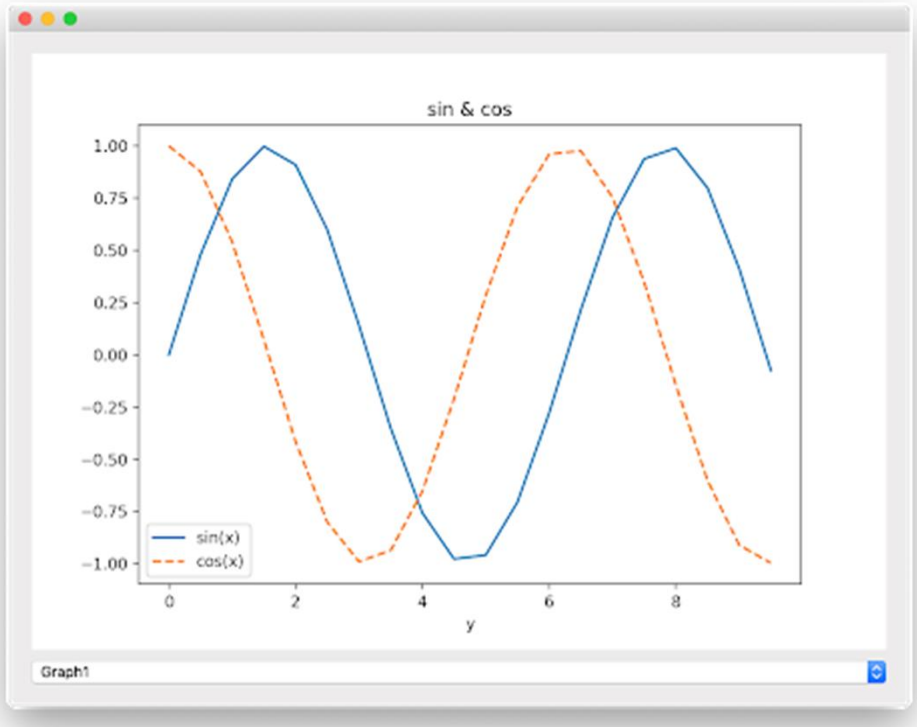
LiveRandomPlot.py *

```
1   import matplotlib.pyplot as plt
2   import numpy as np
3   import random
4
5   plt.title('Live Random Plot')
6   plt.ylabel('value')
7   plt.xlabel('time (s)')
8   plt.ylim(0,10)
9   plt.grid(True)
10  plt.ion()
11
12  x=[]
13  y=[]
14  k=0
15
16  while True:
17      k=k+1
18      x.append(k)
19      y.append(random.randrange(0,10))
20
21      plt.plot(x,y,'c-')
22      plt.show()
23      plt.pause(0.00001)
```

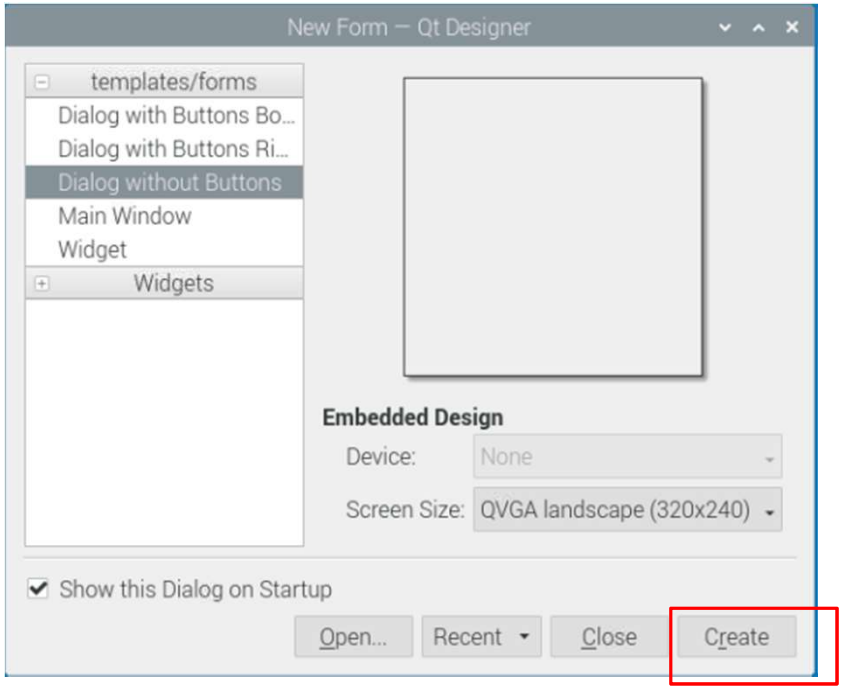
Ex10 : Run



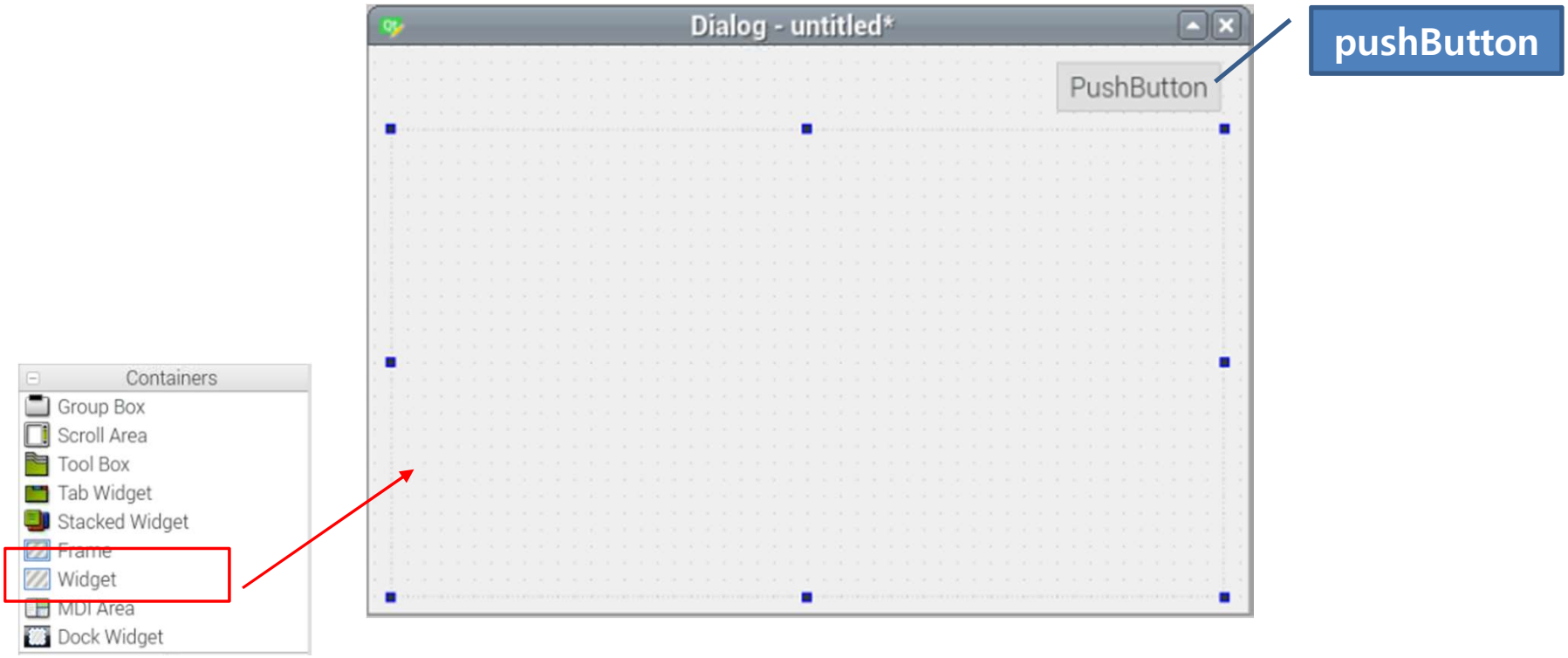
MatPlotLib in PyQt5



New Form – Qt Designer

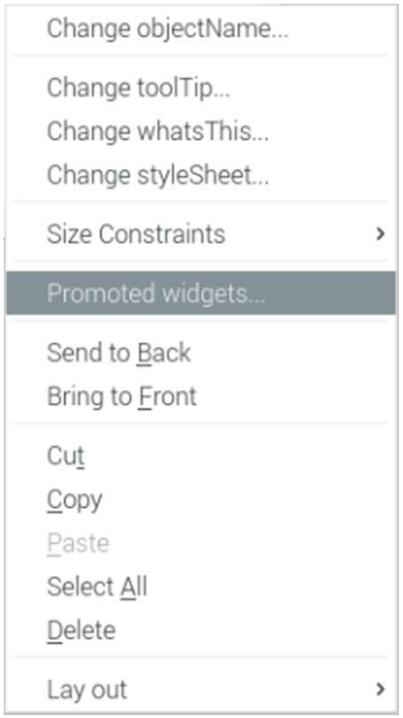


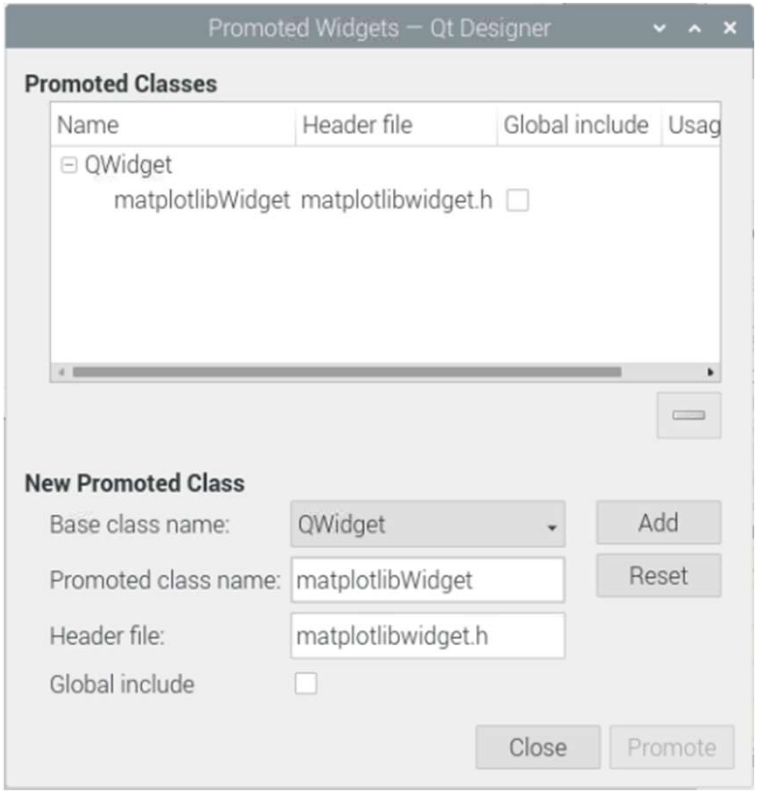
Dialog


Dialog - untitled*
PushButton
pushButton
Containers
Group Box
Scroll Area
Tool Box
Tab Widget
Stacked Widget
Frame
Widget
MDI Area
Dock Widget

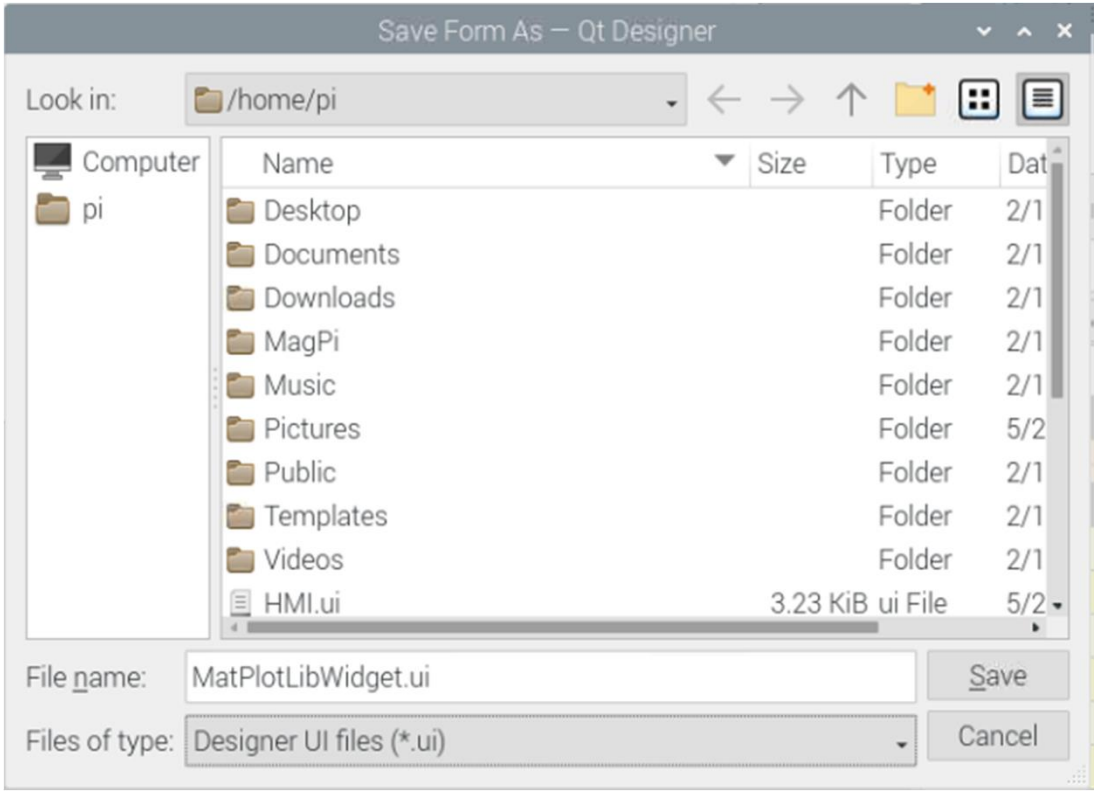
Promoted widget

@ Widget {Mouse-Right}





Save as – MatPlotLibWidget.ui



Thonny – matplotlibwidget.py

matplotlibwidget.py

```
1  import PyQt5
2  from PyQt5.QtGui import *
3  from PyQt5.QtWidgets import *
4
5  from matplotlib.backends.backend_qt5agg import FigureCanvasQTAgg as FigureCanvas
6  from matplotlib.figure import Figure
7
8  class MplCanvas(FigureCanvas):
9
10     def __init__(self):
11         self.fig = Figure()
12         self.ax = self.fig.add_subplot(111)
13
14         FigureCanvas.__init__(self, self.fig)
15         FigureCanvas.setSizePolicy(self, QSizePolicy.Expanding,QSizePolicy.Expanding)
16         FigureCanvas.updateGeometry(self)
17
18 class matplotlibWidget(QWidget):
19
20     def __init__(self, parent = None):
21         QWidget.__init__(self, parent)
22         self.canvas = MplCanvas()
23         self.vbl = QVBoxLayout()
24         self.vbl.addWidget(self.canvas)
25         self.setLayout(self.vbl)
```

Thonny – PyQt5_MatPlotLibWidget.py

PyQt5_MatPlotLibWidget.py

```
1  import sys
2  from PyQt5.QtWidgets import *
3  from PyQt5 import uic
4  import random
5
6  uiDialog='MatPlotLibWidget.ui'
7
8  class MyDialog(QDialog):
9      def __init__(self):
10         QDialog.__init__(self,None)
11         uic.loadUi(uiDialog,self)
12         self.pushButton.clicked.connect(self.buttonClick)
13
14     def buttonClick(self):
15         randomNumbers = random.sample(range(0, 10), 10)
16         self.widget.canvas.ax.clear()
17         self.widget.canvas.ax.plot(randomNumbers)
18         self.widget.canvas.draw()
19
20 if __name__ == '__main__':
21     app=QApplication(sys.argv)
22     form=MyDialog()
23     form.show()
24     app.exec()
```

Run