

Prelab 1.1 IoT Sensor Data Collection 1 - Humidity and Temperature Sensor

Learning Goals

- Students will be able to prepare the basic software requirements in Raspberry Pi to measure sensor data.
- Students will be able to code using basic python functions related to date and time
- Students will be able to create a flow chart that defines the steps to save data into a csv file.

1.1 Introduction

In Lab 1, we will use a digital temperature and humidity sensor, DHT11 module (<https://components101.com/sensors/dht11-temperature-sensor>, available on Jan. 13, 2023), to measure atmospheric temperature and humidity. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and splits out a digital signal on the digital pin.

The DHT11 module is simple to use but requires careful timing to grab data.

Warning! The only real downside of this sensor is you can only get new data from it once every 2 seconds.

There are many applications using the humidity and temperature sensor, such as HVAC (Heating, Ventilation, and Air Conditioning), testing and inspection equipment, consumer goods, automotive, automatic control, data loggers, humidity regulator, and so on.

Prelab 1 is to prepare the DHT11 module use for Lab 1 and to get familiar with Python. In all lab manuals, Python means Python3 if no further descriptions. We will use Raspberry Pi and Python. Lab manuals will mainly describe the use of 'Terminal'. However, if you are a beginner of Python, you can also use Thonny IDE, the default software of Raspberry Pi OS 11. If you are interested, visit and follow this tutorial (<https://roboticsbackend.com/thonny-ide-raspberry-pi-os/>, available on Jan. 13, 2023).

1.2 Python Package Installation

At the first, you need to make Raspberry Pi the latest packages.



```
sudo apt update
```

```
sudo apt upgrade
```

To install Python additional packages, we will use 'pip' package. The 'pip' is the standard package manager for Python. It enables you to install and manage additional packages that are not part of Python library. Let's install 'pip' package first.

Raspberry Pi - Terminal

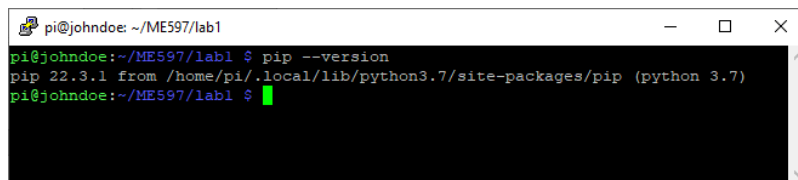
```
sudo apt install python3-pip
```

To check 'pip' version, you can use the command 'pip --version' in 'Terminal'. To see all installed Python packages and versions, use 'pip list' in 'Terminal' as below.

Raspberry Pi - Terminal

```
pip --version
```

```
pip list
```



```
pi@johndoe: ~/ME597/lab1
pi@johndoe:~/ME597/lab1 $ pip --version
pip 22.3.1 from /home/pi/.local/lib/python3.7/site-packages/pip (python 3.7)
pi@johndoe:~/ME597/lab1 $
```

Figure 1 Terminal window to check pip version

Task 1.1

Capture your terminal window as Figure 1 after checking pip version and attach it to the report below:

```

0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
pi@junyiyuan:~$ pip --version
pip 18.1 from /usr/lib/python2.7/dist-packages/pip (python 2.7)
pi@junyiyuan:~$ pip list
Package           Version
-----
arandr            0.1.9
asn1crypto        0.24.0
automationhat     0.2.0
blinker           1.4
blinkt            0.1.2
buttonshim        0.0.2
Cap1xxx           0.1.3
certifi           2018.8.24
chardet           3.0.4
Click             7.0
colorama          0.3.7
configparser      3.5.0b2
cookies           2.2.1
cryptography      2.6.1
drumhat           0.1.0
entrypoints       0.3
enum34            1.1.6
envirophat        1.0.0
ExplorerHAT       0.4.2
Flask             1.0.2
fourletterphat    0.1.0
funcsigs          1.0.2
gpiozero          1.6.2
idna              2.6
ipaddress         1.0.17
RPi.GPIO          0.7.0
RTIMULib          7.2.1
scrollphat        0.0.7
scrollphatd       1.2.1
SecretStorage     2.3.1
sense-hat         2.2.0
setuptools        40.8.0
simplejson         3.16.0
six               1.12.0
skywriter         0.0.7
sn3218            1.2.7
spidev            3.5
touchphat         0.0.1
twython           3.7.0
unicornhathd      0.0.4
urllib3           1.24.1
Werkzeug          0.14.1
wheel             0.32.3
pi@junyiyuan:~$

```

To read DHT11 sensor data, we will use the Python packages developed by Adafruit. Visit and look over the webpage (<https://learn.adafruit.com/dht-humidity-sensing-on-raspberry-pi-with-gdocs-logging/python-setup>, available on Jan. 13, 2023). Let's install the relevant Python packages as followed.



Raspberry Pi - Terminal

```
sudo pip3 install adafruit-blinka
```

#pip3 means pip for Python3. adafruit-blinka will install requirements for adafruit-python-shell if you got error.

```
sudo pip3 install adafruit-python-shell
```

```
sudo pip3 install adafruit-circuitpython-dht
```

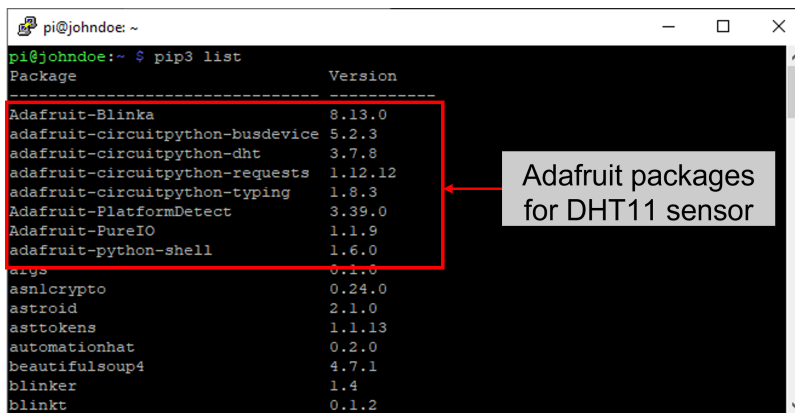
```
sudo apt install libgpod2
```

```
sudo reboot
```

After rebooting Raspberry Pi, you are all set. Let's check installed packages using 'pip3 list' command in 'Terminal' as followed.

Raspberry Pi - Terminal

```
pip3 list
```



```
pi@john DOE: ~  
pi@john DOE:~$ pip3 list  
Package Version  
-----  
Adafruit-Blinka 8.13.0  
adafruit-circuitpython-busdevice 5.2.3  
adafruit-circuitpython-dht 3.7.8  
adafruit-circuitpython-requests 1.12.12  
adafruit-circuitpython-typing 1.8.3  
Adafruit-PlatformDetect 3.39.0  
Adafruit-PureIO 1.1.9  
adafruit-python-shell 1.6.0  
args 0.1.0  
asn1crypto 0.24.0  
astroid 2.1.0  
asttokens 1.1.13  
automationhat 0.2.0  
beautifulsoup4 4.7.1  
blinker 1.4  
blinkt 0.1.2
```

Adafruit packages for DHT11 sensor

Figure 2 Terminal window to check installed Python packages

Task 1.2

Capture your terminal window as Figure 2 to see the installed packages and attach it to the report below:

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  JUPYTER

individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Jan 25 12:57:41 2023
pi@junyiyuan:~ $ pip3 list
Package                                Version
-----
Adafruit-Blinka                        8.13.0
adafruit-circuitpython-busdevice      5.2.3
adafruit-circuitpython-dht            3.7.8
adafruit-circuitpython-requests       1.12.12
adafruit-circuitpython-typing         1.8.3
Adafruit-PlatformDetect               3.39.0
Adafruit-PureIO                       1.1.9
adafruit-python-shell                 1.6.0
args                                  0.1.0
asn1crypto                            0.24.0
astroid                                2.1.0
asttokens                              1.1.13
```

Finally, install 'matplotlib' Python package by using 'pip3' command. We will use 'matplotlib' package to visualize data in the following lab sessions.

Please continue to [Prelab 1.2 here](#).