Lab1:
getting started with LoPy

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Labs

⅓ Ready to use, tested examples

⅓ Exercise based on the examples

⅓ Your imagination → create new applications

Lab alert

The number of variables in the lab settings is huge (computer operating system, firewall, device firmware version, code version, network, etc)

Things will go wrong :-)

Be patient, we will solve all issues!

Found a bug? Let me know! Feedback is welcome.

Hands-on sessions

"Be excellent to each other", asking / helping is OK.

Google error messages to fix issues.

Coping blindly does not lead to new insight.

Reading other people's code helps a lot.

Check Pycom’s documentation.

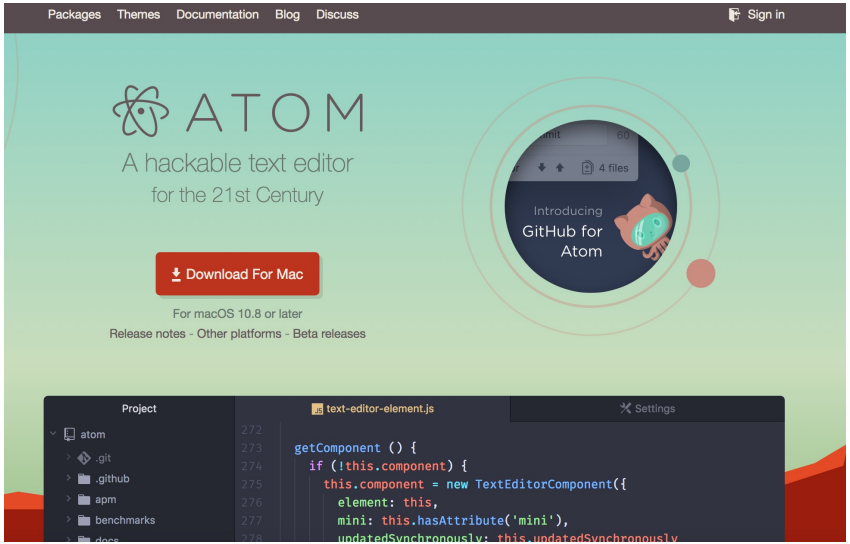
Our Lab equipment

Pycom LoPy 4

PySense

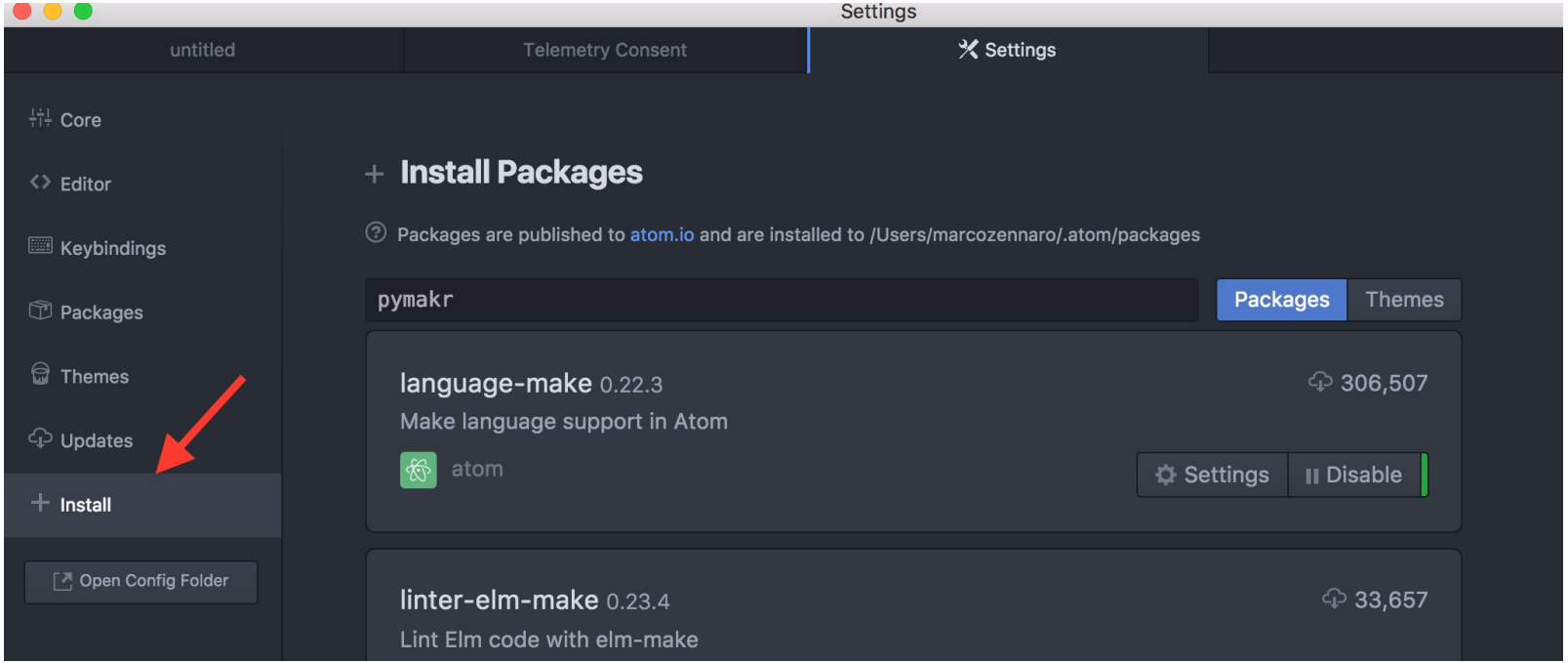
microUSB Cable

Workflow: Atom



Please install from www.atom.io
or update to the latest version.

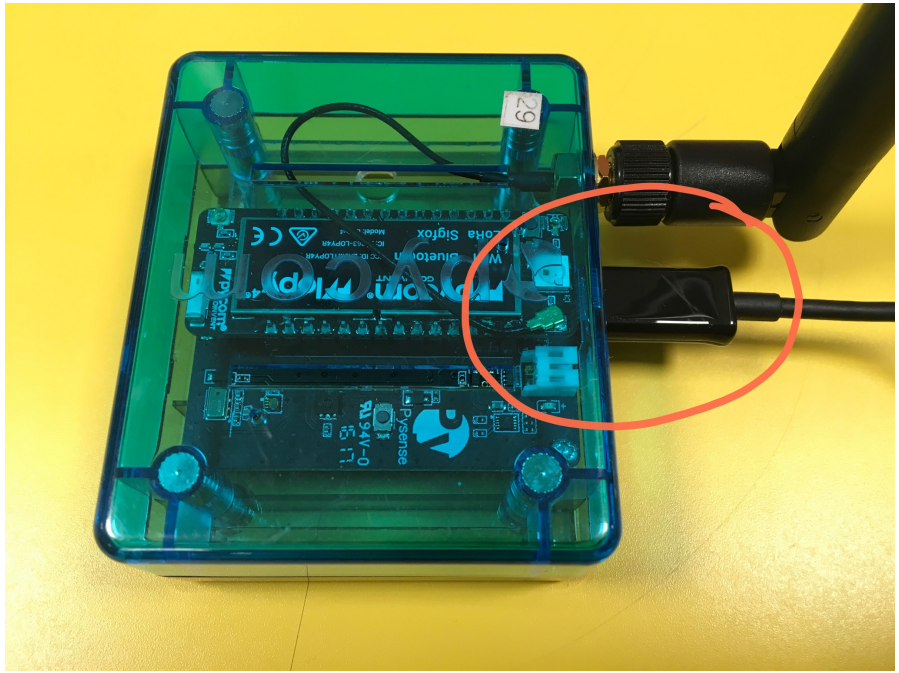
Workflow: install the pymakr package



Preferences → Settings → Install → search **pymakr**

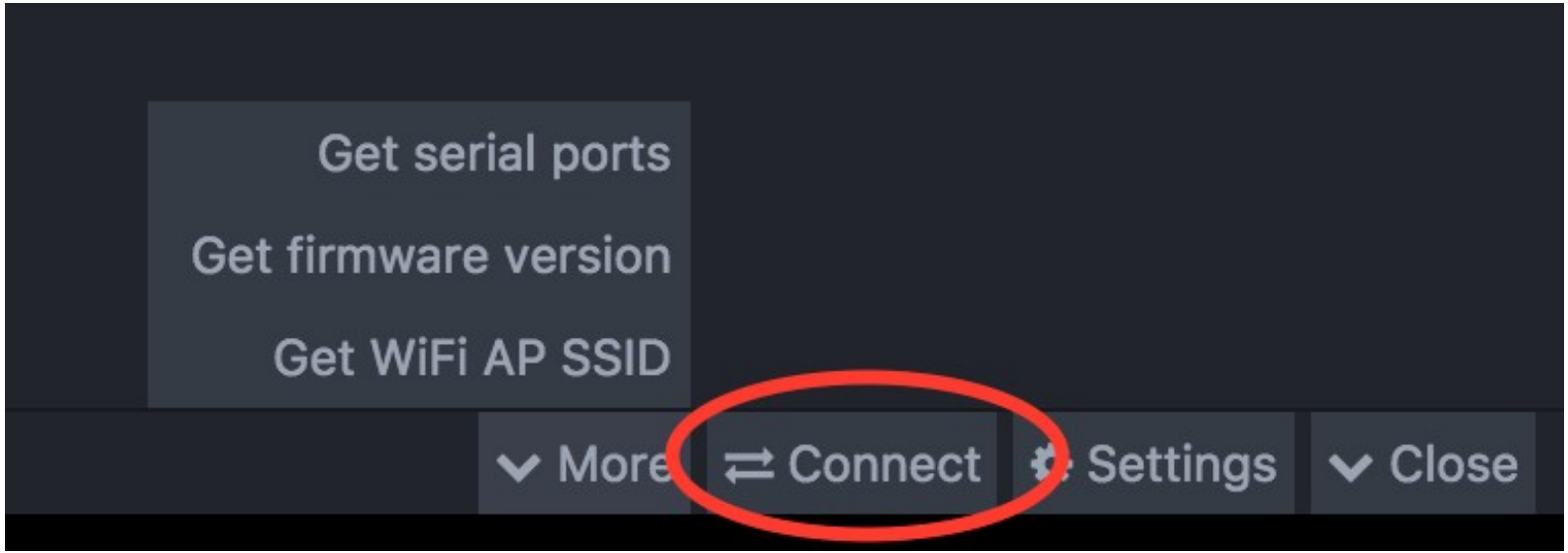
Different on Windows, Mac, Linux

Workflow: connect board via USB



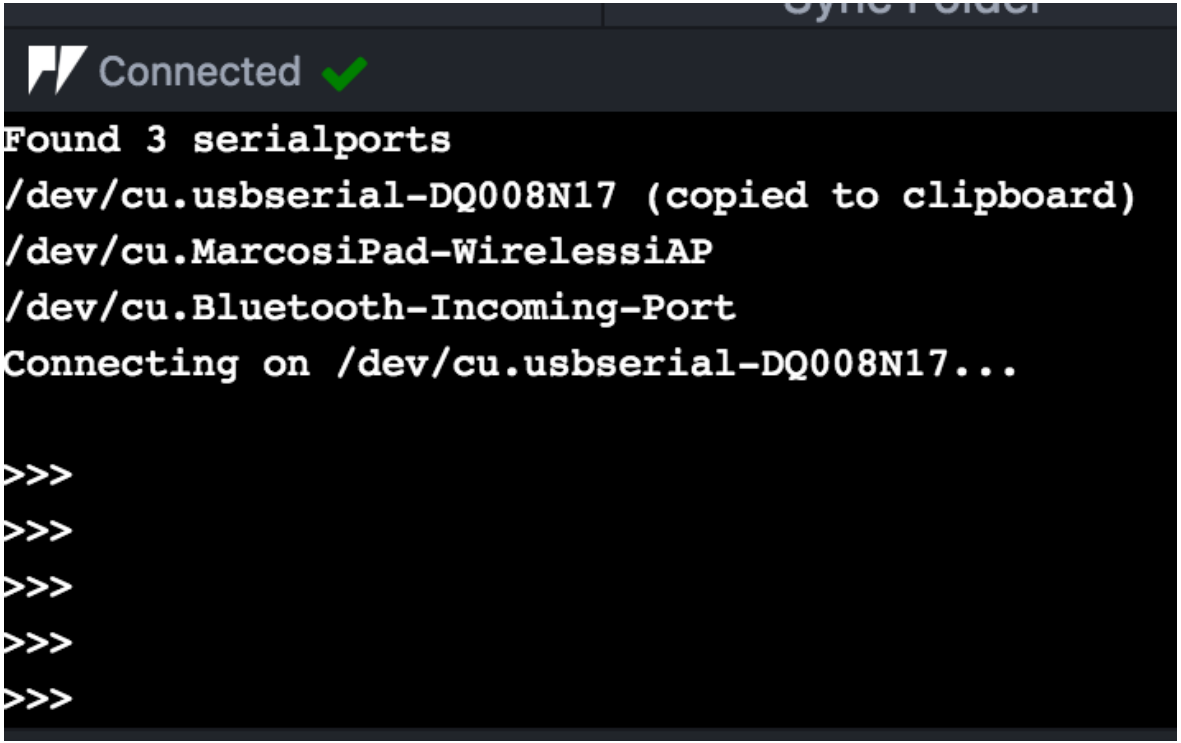
Make sure the LED and the microUSB are on the same side!

Workflow: connect!



Click on Connect

Workflow: REPL



REPL console

REPL stands for Read Print Eval Loop. Simply put, it takes user inputs, evaluates them and returns the result to the user.

You have a complete python console! Try to enter `>>> 2+2` and press Enter.

Now enter: `>>> print("Hi! I am a python shell!")`

Executing code

There are three ways to execute code on a Pycom device:

1) Via the **REPL** shell. Useful for single commands and for testing.

REPL example

The os module can be used for further control over the filesystem. First import the module:

```
>>> import os
```

Then try listing the contents of the filesystem:

```
>>> os.listdir()
```

REPL example

You can make directories:

```
>>> os.mkdir(‘dir_iotlab')
```

And remove entries:

```
>>> os.remove('data.txt')
```

REPL example

If a device's filesystem gets corrupted, it can format it by running:

```
>>> import os
```

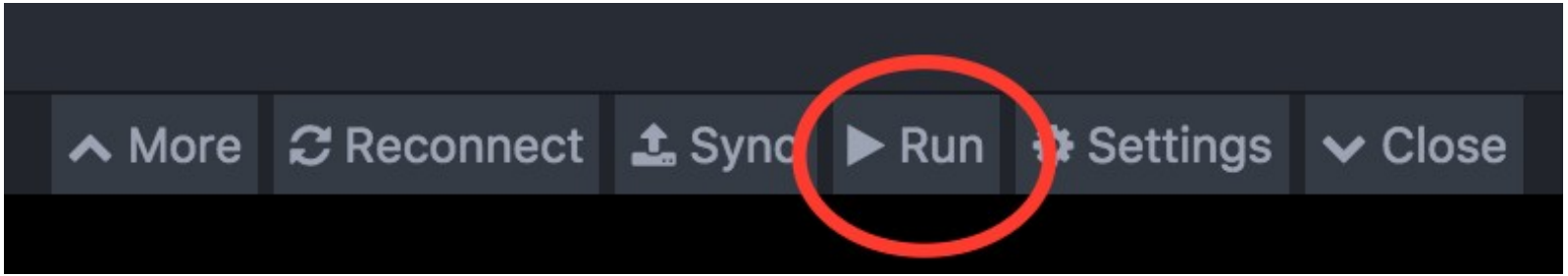
```
>>> os.mkfs('/flash')
```

Executing code

2) Using the **Run** button. Code that is open on the Atom editor will be executed, but will **not be stored in the device**.

If you reboot, the code will not be executed again.

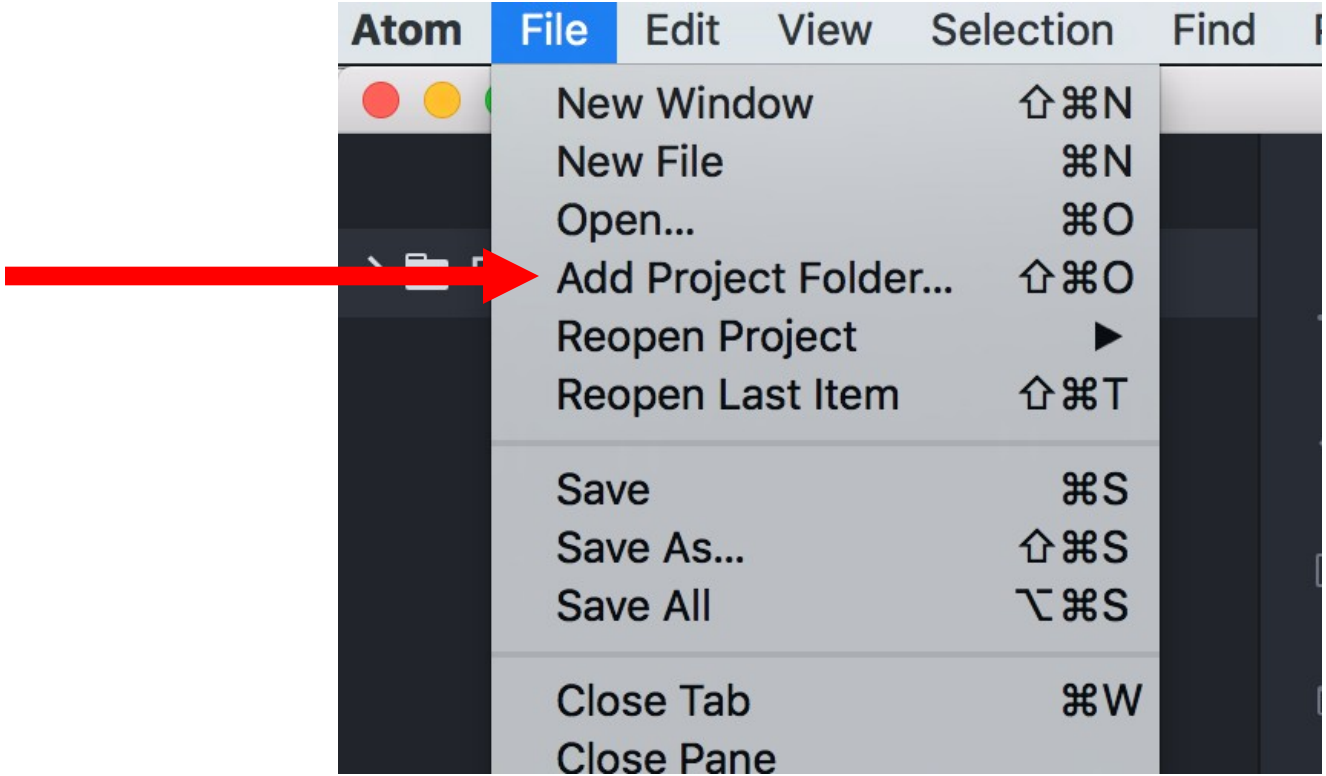
Executing code



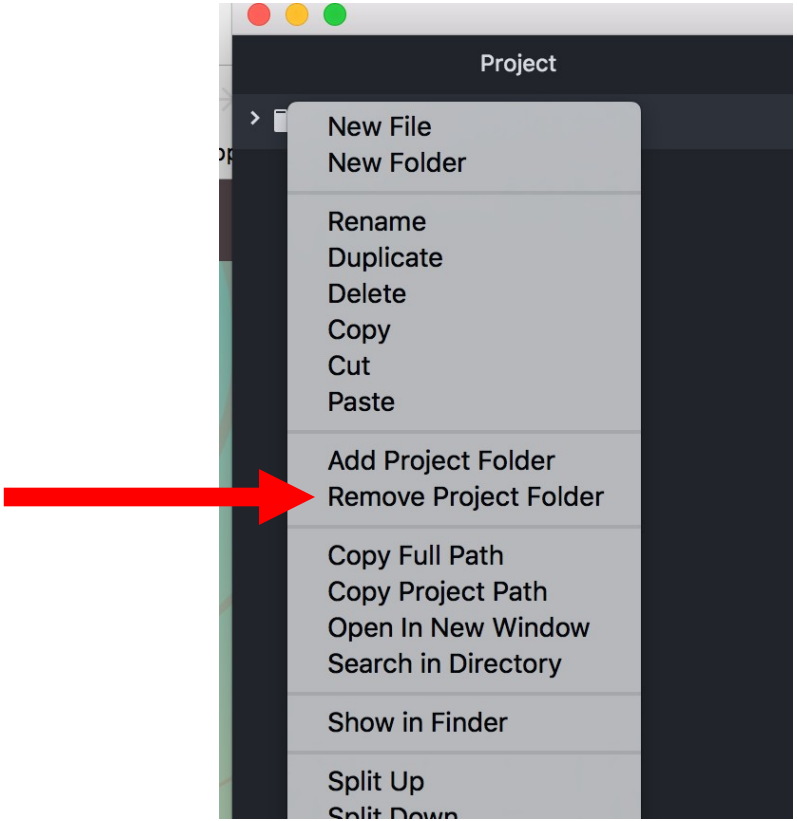
Executing code

3) **Synching** the device with the **Project folder** in Atom. In this way, the code is stored in the Pycom device and will be executed again if you reboot the device.

Workflow: project folder



Workflow: ONE project folder



It is easier if you only have one Project folder. Make sure you Remove any other Project folders and **keep only the one you want to use.**

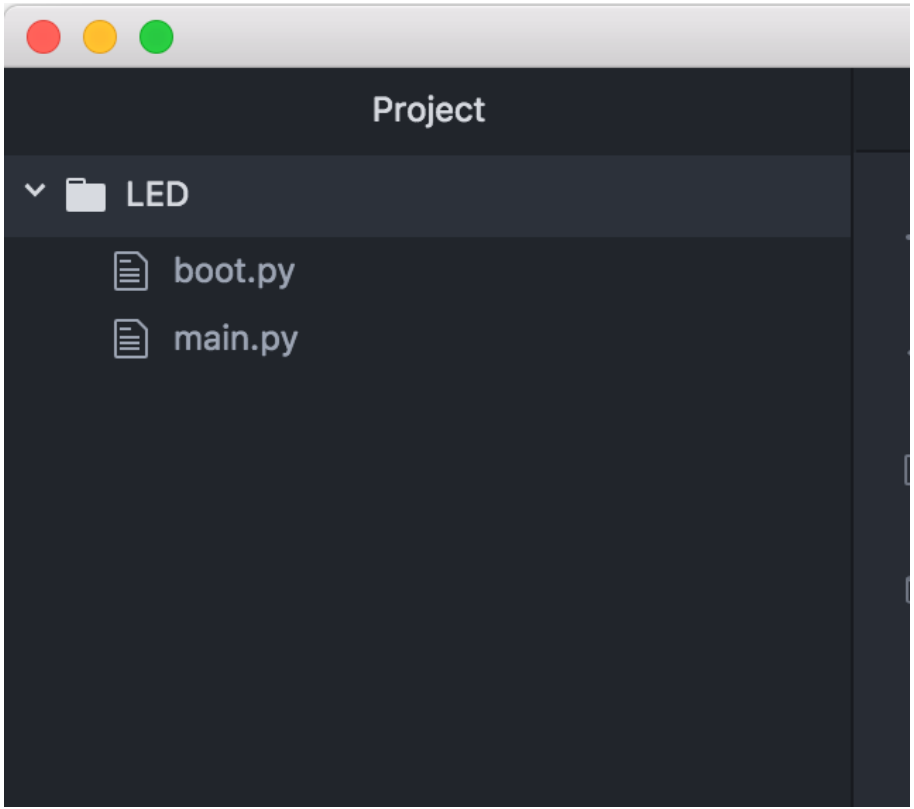
Workflow: project folder

The Project folder should contain all the files to be synched with the device.

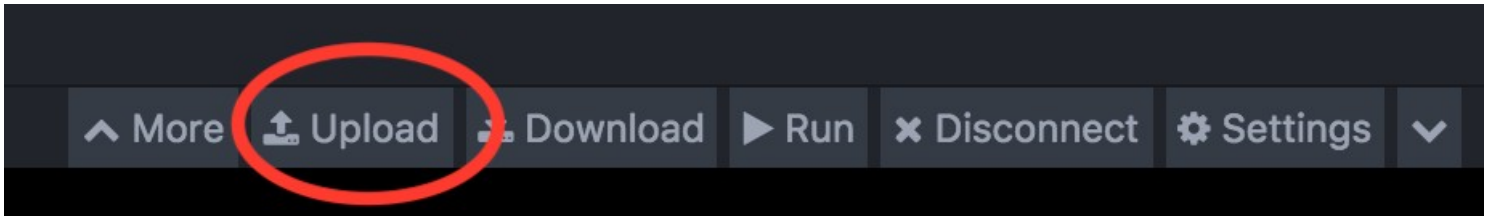
You should always have two files: **boot.py** (executed at boot time) and **main.py** (containing the main code).

The folder can also include libraries and other python files.

Workflow: example of project folder

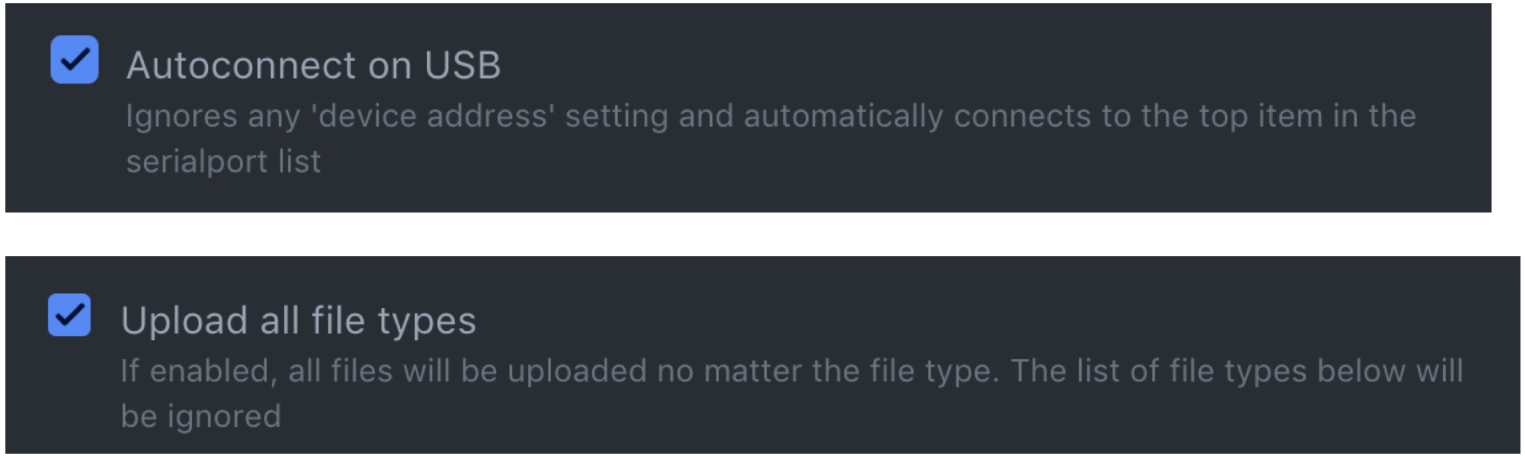


Workflow: upload project folder

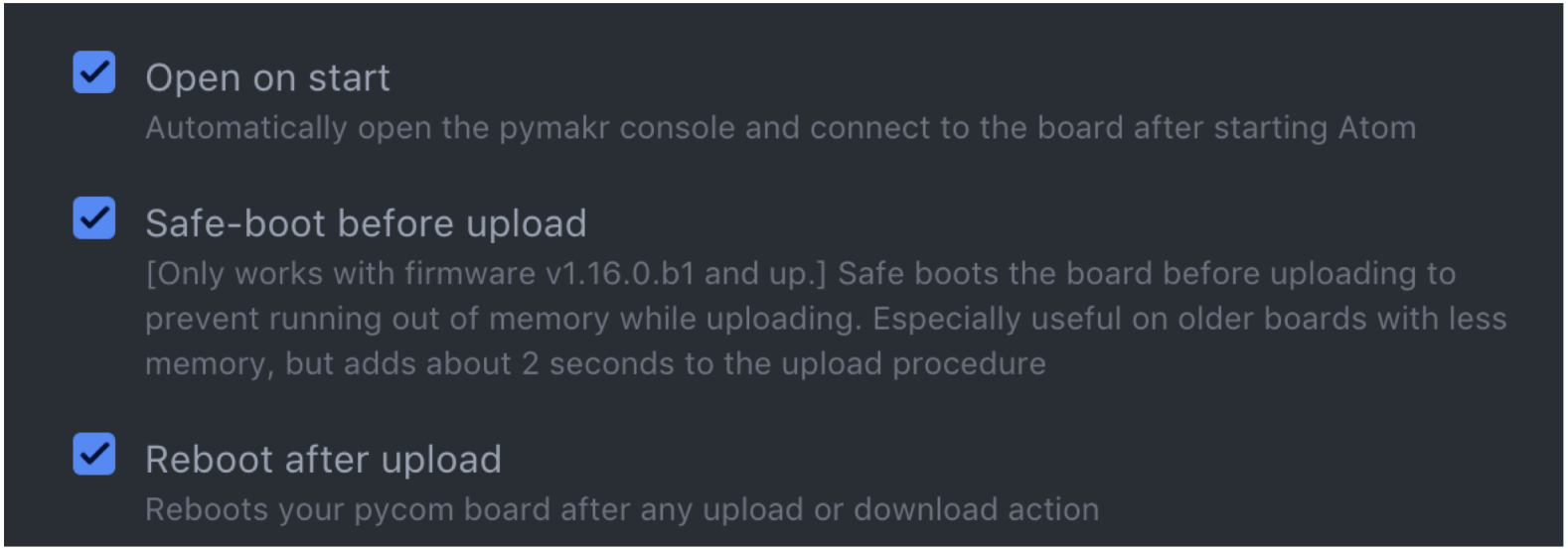


Workflow: useful Atom settings

Settings → Global Settings



Workflow: useful Atom settings



Workflow: boot.py

The boot.py file should always start with following code, so we can run our Python scripts over a serial connection (USB).

```
from machine import UART
import os
uart = UART(0, 115200)
os.dupterm (uart )
```

Alternative to Atom: mpy-repl-tool

mpy-repl-tool is a software tool that you can use to connect and control a LoPy via the command line

http://mpy-repl-tool.readthedocs.io/en/latest/index.html

To install it you have to execute:

```
$ python3 -m pip install mpy-repl-tool
```

Alternative to Atom: mpy-repl-tool

This command will list the serial ports and "hopefully" will automatically find your LoPy board.

```
$ python3 -m there detect
```

To get a list of the files on the LoPy run:

```
$ python3 -m there ls -l /flash/*
```

Alternative to Atom: mpy-repl-tool

To uload the code files from your computer to the LoPy:

```
$ python3 -m there push *.py /flash$ python3 -m
```

To start a serial terminal and get access to the REPL:

```
$ python3 -m there -i
```

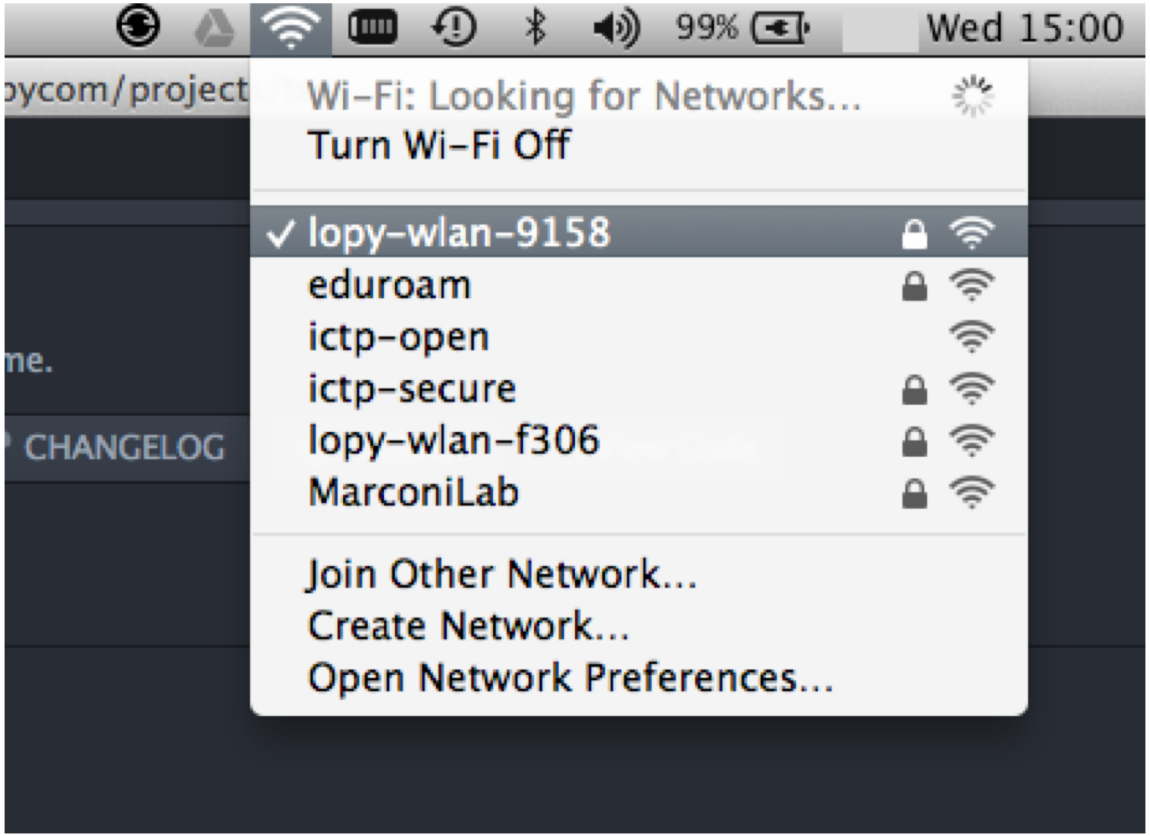
Connect to a LoPy via WiFi

If you have driver issues (eg running Windows 7), you can have access the LoPy via a WiFi connection.

Your LoPy by default works as a WiFi access point. Search an SSID that looks like lopy-wlan-XXXX; the password is www.pycom.io; connect to it.

On the back of each device you can find the last 4 characters of the LoPy AP name.

Connect to a LoPy via WiFi



Connect to a LoPy via WiFi

To tell Atom to connect via WiFi instead of via USB,

Settings → Global Settings → Device Address

Enter: 192.168.4.1

You are now connected to the LoPy vis WiFi.

Resetting

They are different ways to reset your device. Pycom devices support both **soft and hard resets**.

A soft reset clears the state of the MicroPython virtual machine but leaves hardware peripherals unaffected. To do a **soft reset**:

press Ctrl+D on the REPL

Resetting

A **hard reset** is the same as performing a power cycle to the device. In order to hard reset the device, press the reset switch or run:

```
>>> import machine

>>> machine.reset()
```

LED

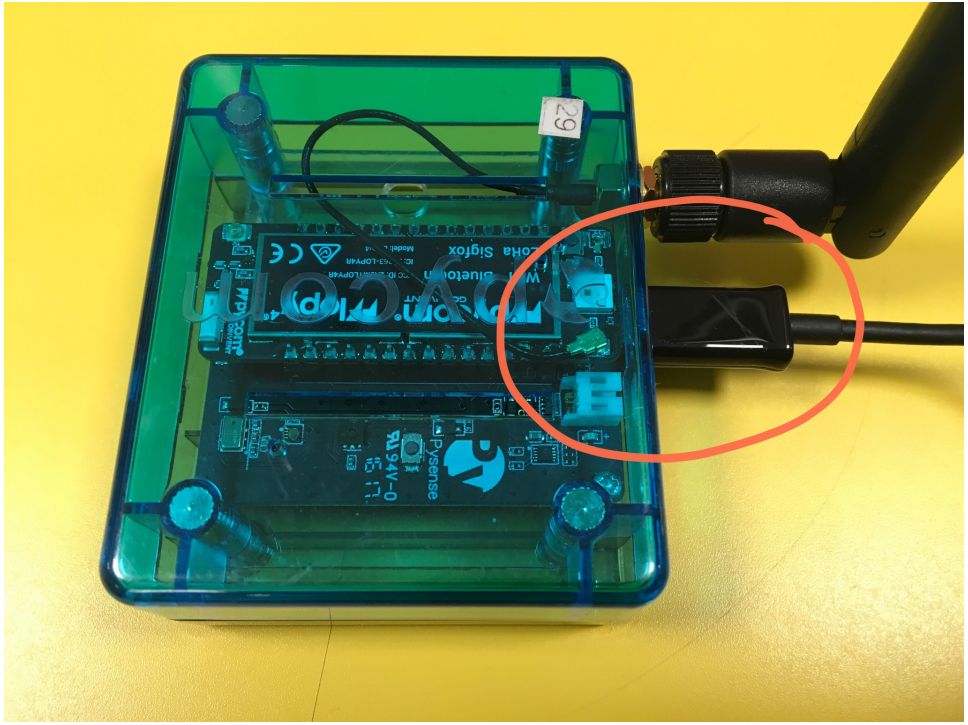
LED

In this example, we will create and deploy the proverbial 1st app, “Hello, world!” to a Pycom device.

LoPys don’t have screens!

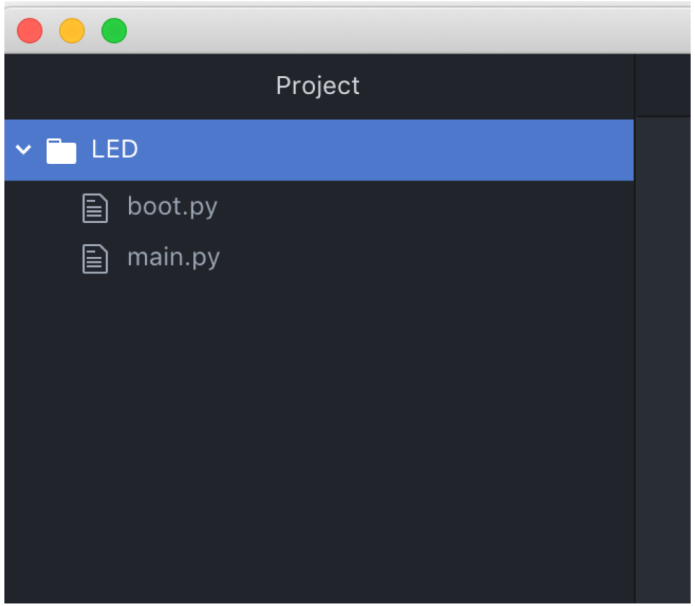
The LoPy module has one LED (big, white LED on the same side as the microUSB).

LED



LED

Check the **LED folder** and sync the two files to your active project folder.



LED example, part 1

```
import pycom

import time

pycom.heartbeat(False)
```

Import the python libraries needed

Set OFF the heartbeat (the LED turns blue to show that the device is alive) as we will change the color of the LED

LED example, part 1

```
for cycles in range(10):
    pycom.rgbled(0x007f00) # green
    time.sleep(5)
    pycom.rgbled(0x7f7f00) # yellow
    time.sleep(5)
   pycom.rgbled(0x7f0000) # red
    time.sleep(5)
```

Execute 10 times

Change LED color to green, yellow and red

Sleep for 5 seconds each time

LED: Exercises

1) Try to send an SOS message using the LED. The SOS message is

line-line-line-dot-dot-dot-line-line-line in morse code, where a line is three times longer than a dot.

LED: Exercises

2) Try to change the color of the LED gradually (from yellow to red, for example).

Flash

Flash

While one of the primary purpose of IoT is to collect and exchange data over an inter-connected network, it is as well important to be able to persist information in the IoT device itself: log files of device's activity, etc.

This is especially useful when network connection is not reliable.

Flash

The LoPy folder tree is the following:

/ (root)

/flash

main.py

boot.py

/lib

/cert

/sys

/sd (if mounted)

Flash

By default, when you sync main.py, boot.py, ... from your Atom project, these files are written into the **flash** folder.

Let's explore and navigate the folder structure interactively. Connect to a Lopy via the REPL and import the basic operating system module (os):

```
import os
```

Flash

Once imported:

to know you current working directory: os.getcwd() (most probably the /flash folder);

to list folders and files in your current working directory: os.listdir()

to create a new folder/directory named "log": os.mkdir('log')

Flash example

In Code/flash you will find an example of code that writes and reads a file. It also creates a directory if it does not exist.

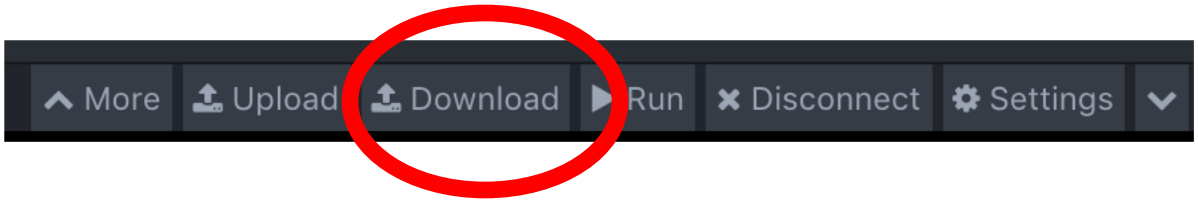
Flash: Exercises

1) Write a code that creates a file named ”name.txt" in /flash/log/ folder containing your group’s name.

2) Write a code that creates a file named "log.csv" in /flash/log/ folder that saves the time value every 10 seconds.

Flash: downloading files

Similar to how you upload files to the LoPy, you can download files from the LoPy to your PC using Atom.



The downloaded files will appear in your Project folder.

PySense

PySense: high-level modules

In this lab, we will provide a series of examples to use the sensors in the PySense module.

Pycom provides a library abstracting the implementation details of sensor chips. This library is already included in labs code under the “lib” folder of each example.

PySense: high-level modules

accelerometer in Code/pysense/acceloremeter

ambient light in Code/pysense/ambient-light

temperature and atmospheric pressure in Code/pysense/temp-bar

temperature and humidity in Code/pysense/temp-hum

PySense: Exercises

1) Change the color of the LED based on accelerometer measurements (green, orange, red if the values of acceleration is small, medium or large)

PySense: Exercises

2) Find where is the temperature sensor and where is the light sensor. Use the datasheet (in the Code folder) or the Pycom website.

PySense: Exercises

3) Log the measurements of temperature every 10 seconds and the measurements of humidity every 30 seconds into the /flash/log folder and blink the LED to green when taking the measurement.

Summary

We introduced the Pycom workflow.

We learned how to change the color of the LED, save a file on the internal flash and read values from the PySense.

We looked at alternatives to Atom and to the serial connection.

Feedback?

Email mzennaro@ictp.it