

BUILDING YOUR LOW-COST IOT PLATFORMS & DEMO OF LONG-RANGE IOT PLATFORM

ISPACE, ACCRA, GHANA
JUNE 17TH, 2016



PROF. CONGDUC PHAM
[HTTP://WWW.UNIV-PAU.FR/~CPHAM](http://www.univ-pau.fr/~cpham)
UNIVERSITÉ DE PAU, FRANCE



RURAL SENSING APPLICATIONS

Moisture/
Temperature
of storage
areas



10-15kms



GSM GPRS
Pay subscription
Limitation of coverage
High energy consumption

Soil
parameters
such as soil
humidity



RURAL SENSING APPLICATIONS

Moisture/
Temperature
of storage
areas



10-15kms



No subscription
Deploy own network
Low energy consumption

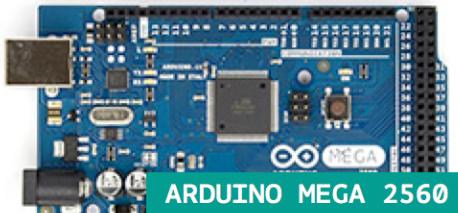
Soil
parameters
such as soil
humidity



BUILDING YOUR IOT DEVICE



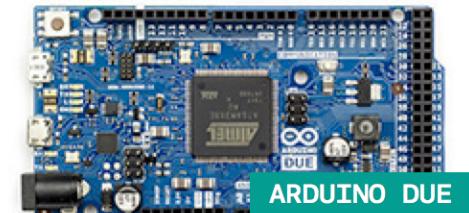
ARDUINO UNO



ARDUINO MEGA 2560



ARDUINO ZERO



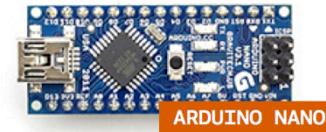
ARDUINO DUE



ARDUINO MICRO



ARDUINO PRO MINI



ARDUINO NANO



Ideetron Nexus



Teensy3.1/3.2



LoRa radios that
our library already
supports



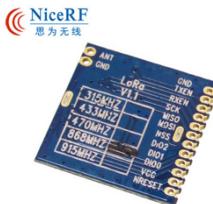
HopeRF
RFM92W/95W



Libelium LoRa



Modtronix
inAir9/9B



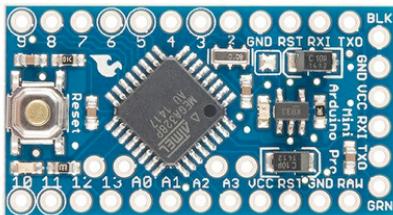
LoRa1276
NiceRF
LoRa1276

Long-Range communication library



THE ARDUINO PRO MINI

Arduino Pro Mini



3.3v and 8MHz version

Avec la bootloader 1 pcs Pro Mini ATMEGA328 Pro Mini 3.3v 8MHz pour Arduino

[View original title in English](#)

★★★★★ 4.9 (417 Votes) | 434 Commandes

Prix : **€ 1,49 / Kit**

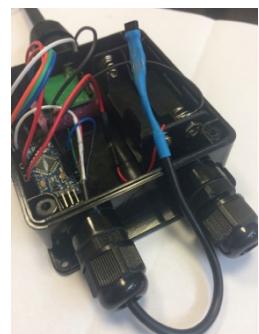
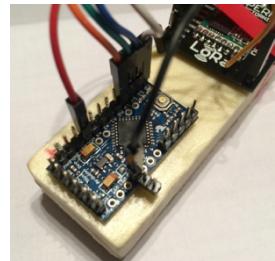
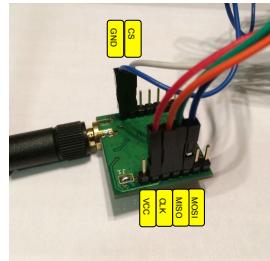
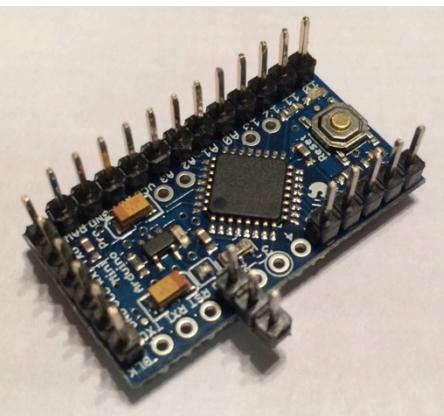
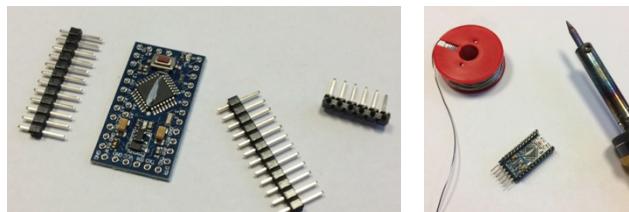
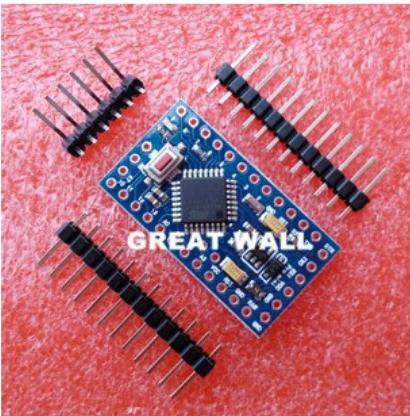
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Livraison : **€ 0,29 vers France via China Post Ordinary Small Packet**
Livraison : 15-34 jours (envoyé en 7 jours ouvrables)

Quantité : Kit (55350 Kits available)

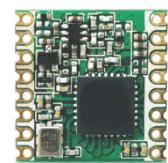
Montant total : **€ 1,78**

[Acheter maintenant](#) [Ajouter au panier](#)





LoRa radios that
our library already
supports



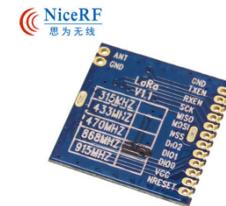
HopeRF
RFM92W/95W



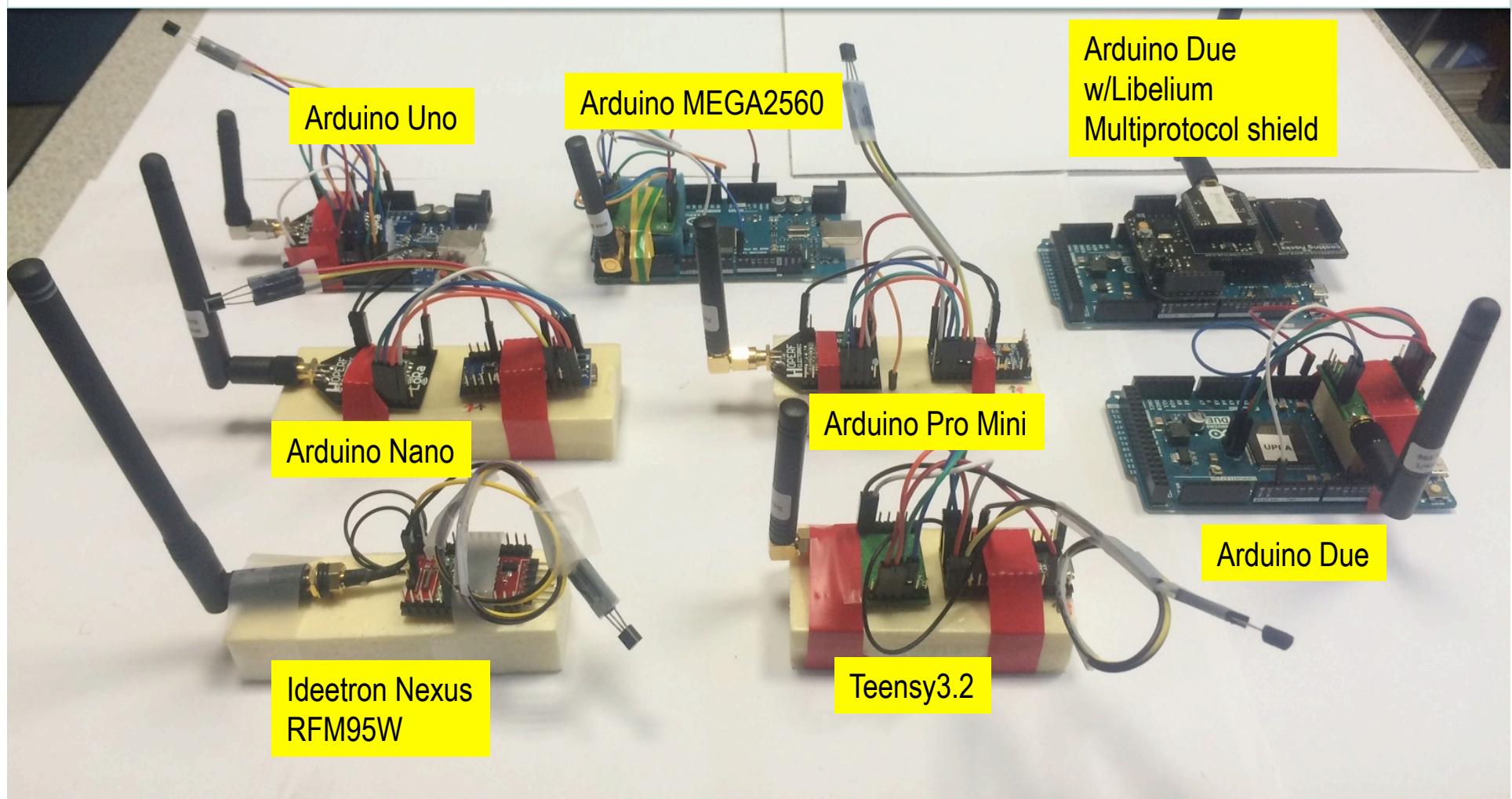
Libelium LoRa



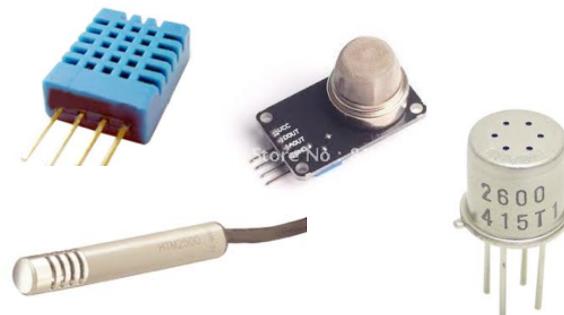
Modtronix
inAir9/9B



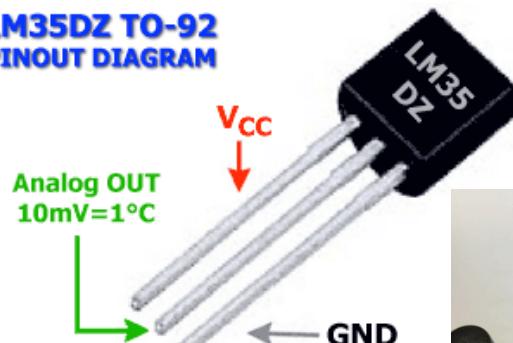
LoRa1276
NiceRF
LoRa1276



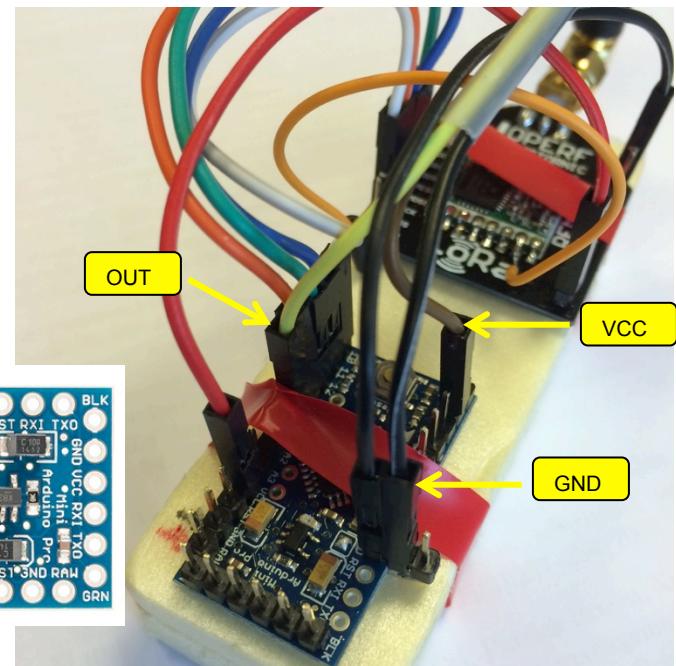
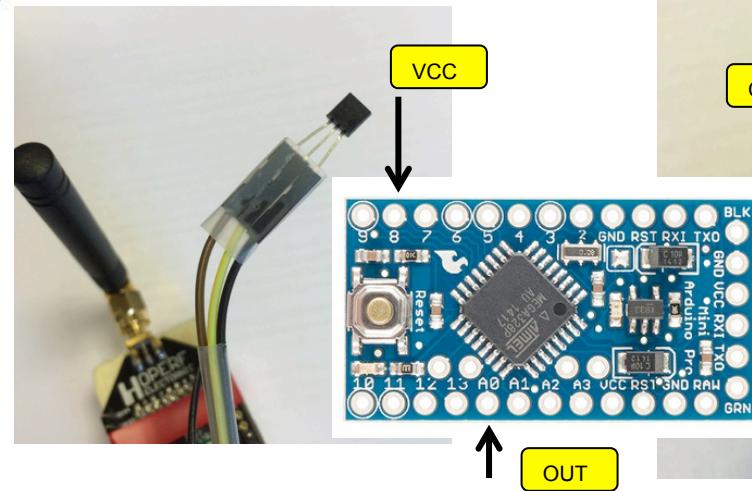
CONNECTING A SENSOR



**LM35DZ TO-92
PINOUT DIAGRAM**



www.Vcc2GND.com



READY-TO-USE TEMPLATES



Physical
sensor
reading



Physical
sensor
reading



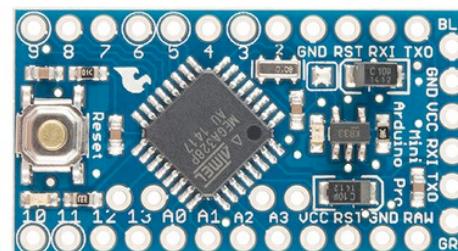
Physical
sensor
reading



IoT catalogue
Code generation



Physical
sensor
management



Activity duty-
cycle, low
power

Security

Long-range
transmission

Logical sensor
management



GETTING THE SOFTWARE

```

Arduino_LoRa_temp | Arduino 1.6.6

/*
 * temperature sensor on analog 3 to test the LoRa gateway
 *
 * Copyright (C) 2015 Congduc Pham, University of Pau, France
 *
 * This program is free software: you can redistribute it and/or modify
 * it under the terms of the GNU General Public License as published by
 * the Free Software Foundation, either version 3 of the License, or
 * (at your option) any later version.
 *
 * This program is distributed in
 * but WITHOUT ANY WARRANTY; without
 * MERCHANTABILITY or FITNESS FOR
 * GNU General Public License for
 *
 * You should have received a copy
 * along with the program. If not
 */
*****  

// Include the SX1272
#include "SX1272.h"  

// IMPORTANT
// please uncomment only 1 choice
// it seems that both HopeRF and M
// boards we set the initial power
// uncomment if your radio is an M
#define RADIO_RFM92_95
// uncomment if your radio is a M
// #define RADIO_INA198
// *****  

// TUDOSTANT
  

11   Teensy 3.2 / 3.1, Serial, 72 MHz optimized, US English on /dev/cu.usbmodem143301

```

CongducPham / LowCostLoRaGw

Code Issues 6 Pull requests 0 Pulse Graphs

Low-cost LoRa gateway with SX1272 and Raspberry

11 commits 1 branch 0 releases 0 contributors

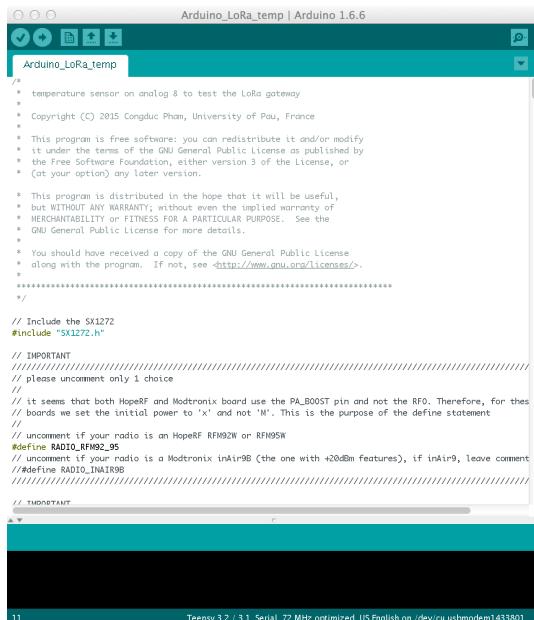
Branch: master New pull request New file Find file HTTPS https://github.com/Congdu... Download ZIP

		Latest commit a46b0f7 10 days ago
Arduino	modified some low-power info	10 days ago
Raspberry	modified some low-power info	10 days ago
.DS_Store	changes in the SX1272 lib, gateway and temperature example	2 months ago
README.md	modified some low-power info	10 days ago
Arduino_LoRa_Gateway	modified some low-power info	10 days ago
Arduino_LoRa_temp	modified some low-power info	10 days ago
libraries/SX1272	Added Teensy support	21 days ago

First, you will need the Arduino IDE 1.6.6 or later (left). Then get the LoRa library from our github: <https://github.com/CongducPham/LowCostLoRaGw> (right).

Get into the Arduino folder and get both Arduino_LoRa_temp and SX1272 folder. Copy Arduino_LoRa_temp into your “sketch” folder and SX1272 into “sketch/libraries”

COMPILING



```

/*
 * temperature sensor on analog 8 to test the LoRa gateway
 *
 * Copyright (C) 2015 Congduc Pham, University of Pau, France
 *
 * This program is free software: you can redistribute it and/or modify
 * it under the terms of the GNU General Public License as published by
 * the Free Software Foundation, either version 3 of the License, or
 * (at your option) any later version.
 *
 * This program is distributed in the hope that it will be useful,
 * but WITHOUT ANY WARRANTY; without even the implied warranty of
 * MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
 * GNU General Public License for more details.
 *
 * You should have received a copy of the GNU General Public License
 * along with the program. If not, see <http://www.gnu.org/licenses/>.
 */
*****  

// Include the SX1272
#include "SX1272.h"  

// IMPORTANT  

// please uncomment only 1 choice  

//  

// it seems that both HopeRF and Madtronix board use the PA_BOOST pin and not the RFO. Therefore, for these  

// boards we set the initial power to 'x' and not 'N'. This is the purpose of the define statement  

//  

// uncomment if your radio is an HopeRF RFM92 or RFM95
#define RADIO_RF92_95
// uncomment if your radio is a Madtronix inAir9B (the one with +20dBm features), if inAir9, leave comment
#define RADIO_INAIR9B  

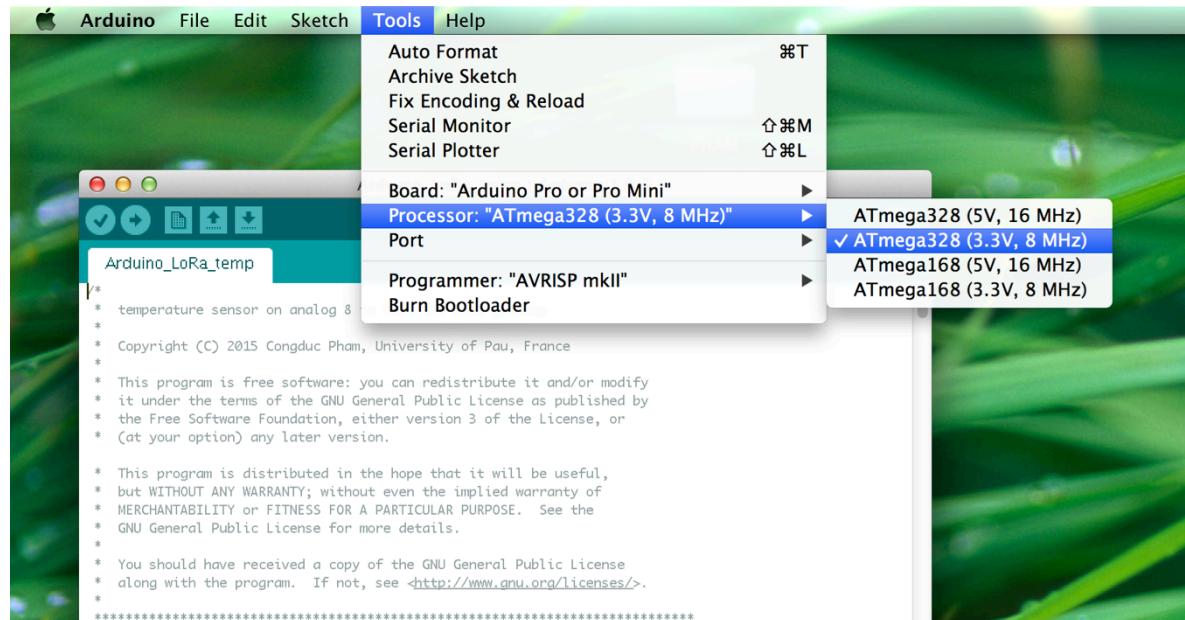
  

// TUDOSTANT
  

11   Teensy 3.2 / 3.1, Serial, 72 MHz optimized, US English on /dev/cu.usbmodem143301

```

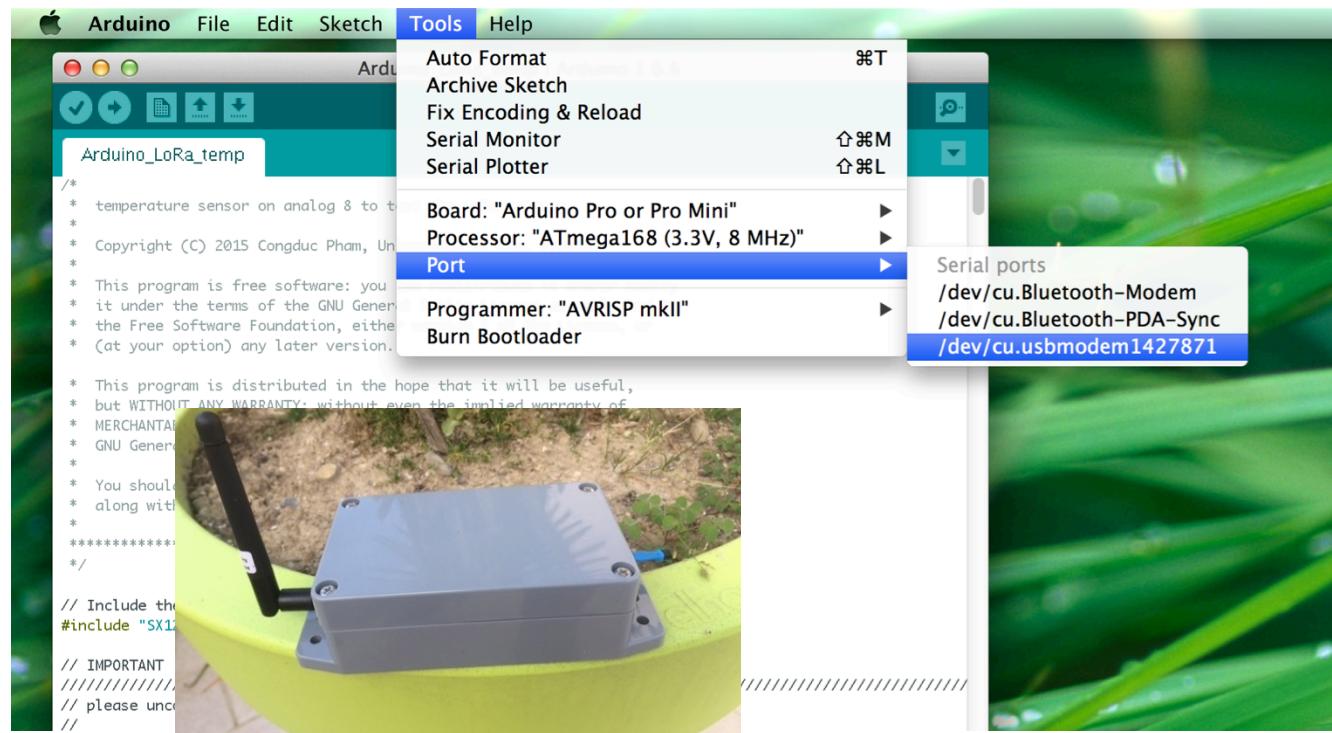


Open the Arduino_LoRa_temp sketch and select the Arduino Pro Mini board with its 3.3V & 8MHz version.

Then, click on the « verify » button



UPLOADING



Connect the USB end to your computer and the USB port should be detected in the Arduino IDE. Select the serial port for your device. It may have another name than what is shown in the example. Then click on the « upload » button



OUPS, ONE MORE STEP!

Moisture/
Temperature
of storage
areas



10-15kms



NEED A GATEWAY!



BUILDING YOUR IOT GATEWAY

RPI v1 model B



RPI v1 model B+



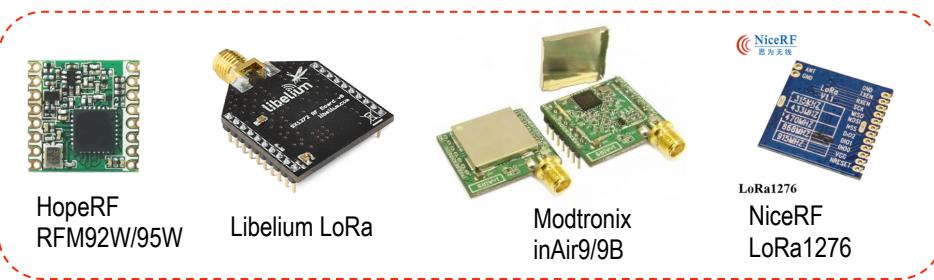
RPI v2 model B



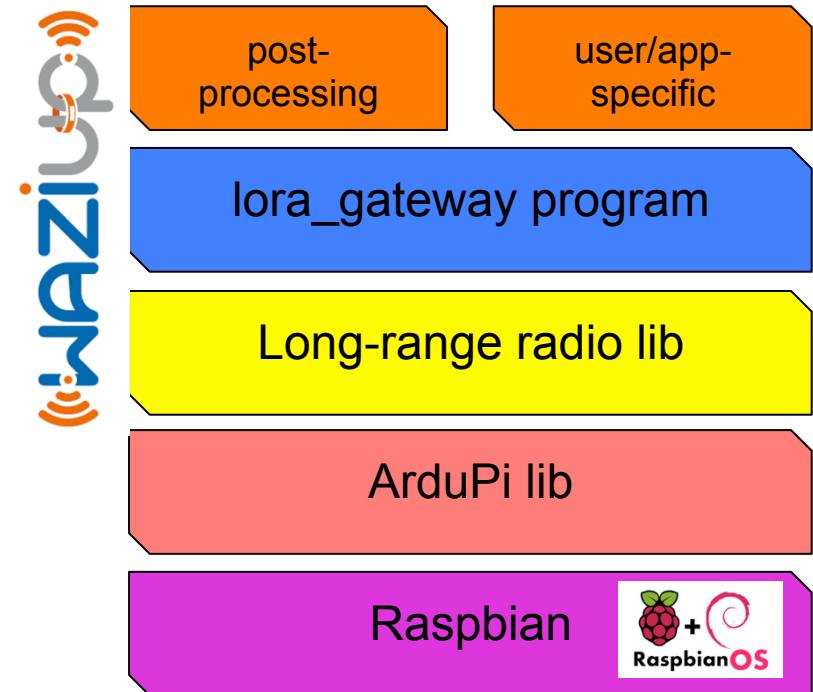
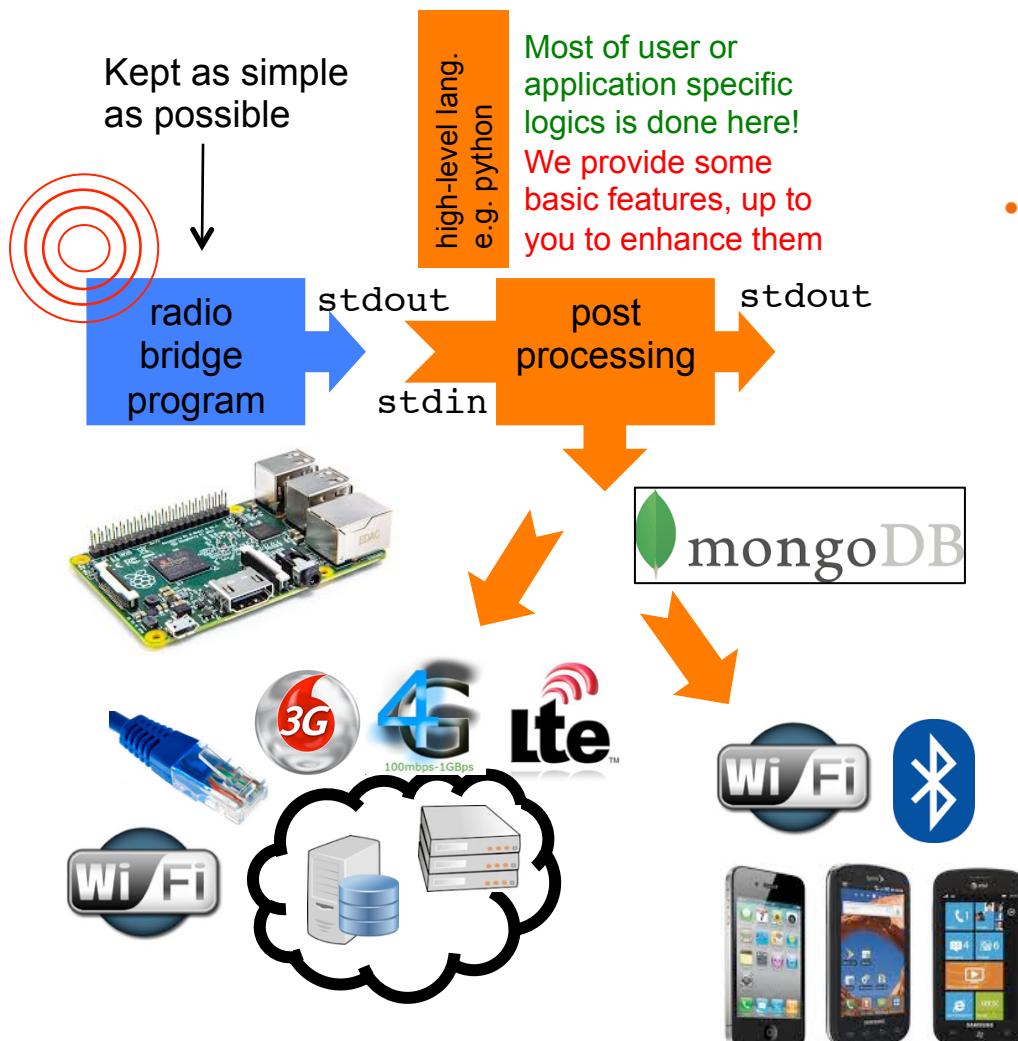
RPI v3 model B



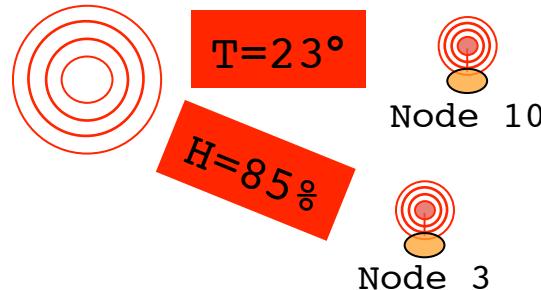
LoRa radios that
our library already
supports



OUR LOW-COST GATEWAY ARCHITECTURE



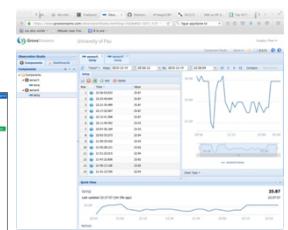
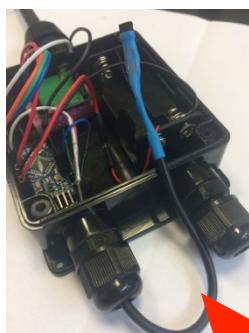
STARTING THE BASIC GATEWAY



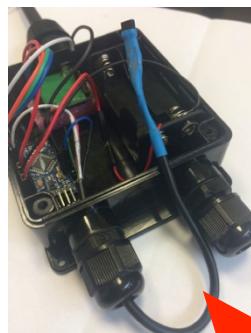
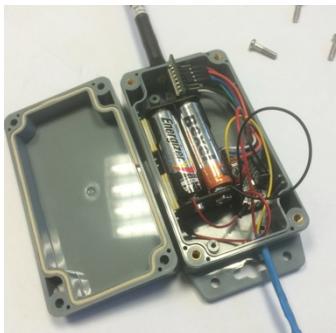
```
> sudo ./lora_gateway
Power ON: state 0
LoRa mode: 4
Setting mode: state 0
Channel CH_10_868: state 0
Power M: state 0
Get Preamble Length: state 0
Preamble Length: 8
LoRa addr 1 : state 0
SX1272/76 configured as LR-BS. Waiting RF input for transparent RF-serial bridge

--- rxlora. dst=1 type=0x10 src=10 seq=0 len=5 SNR=9 RSSIpkt=-54
^p1,16,10,0,5,9,-54
T=23°
--- rxlora. dst=1 type=0x10 src=3 seq=0 len=5 SNR=8 RSSIpkt=-54
^p1,16,3,0,5,8,-54
H=85%
```

OUT-OF-THE-BOX SURVEILLANCE



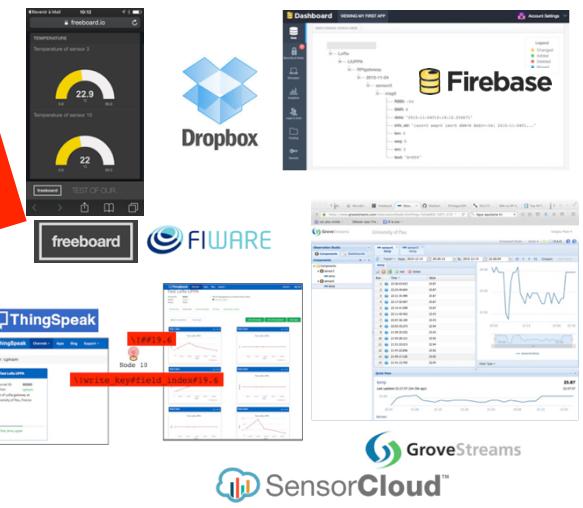
DO IT YOURSELF !



Step-by-step tutorial
and source code
available



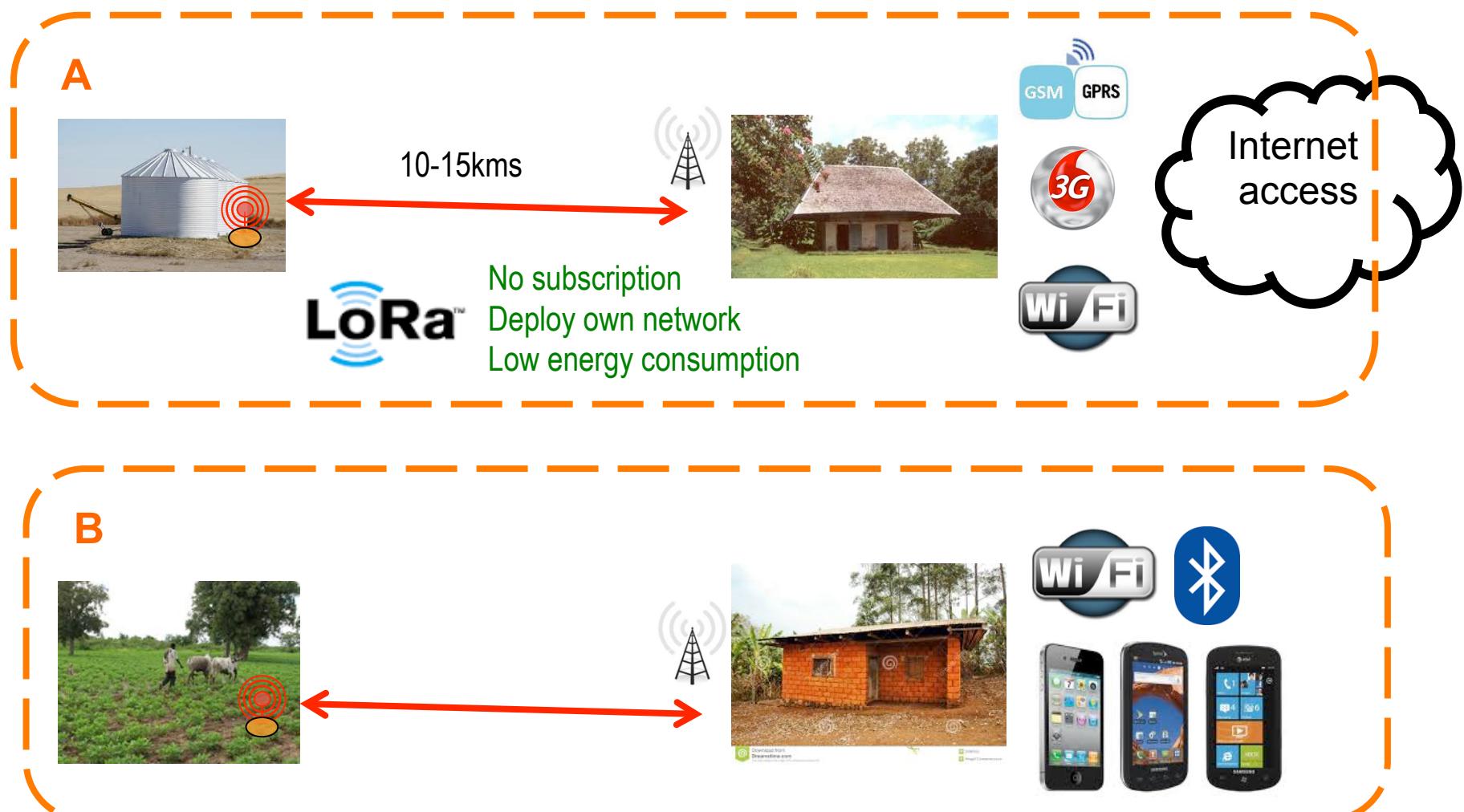
Step-by-step tutorial
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available



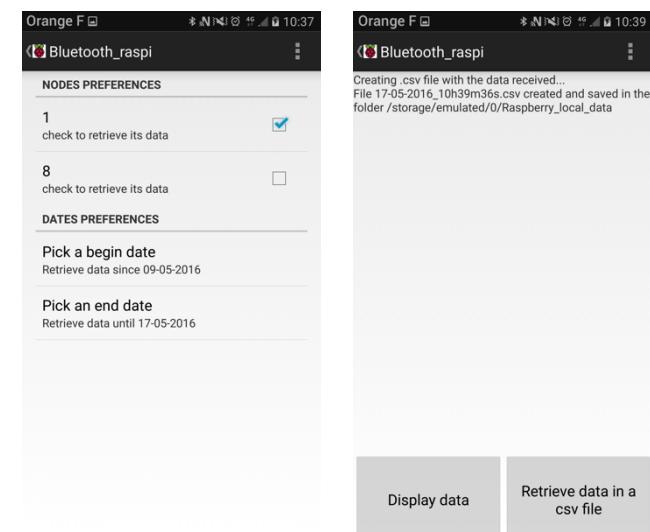
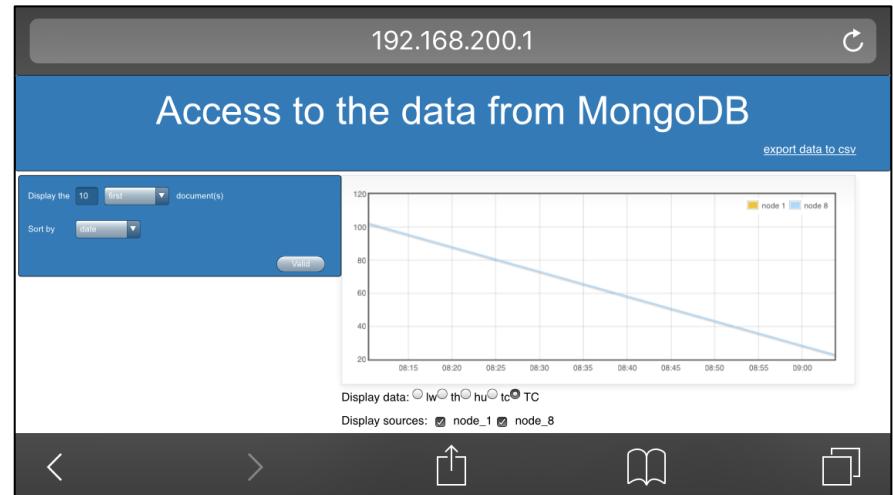
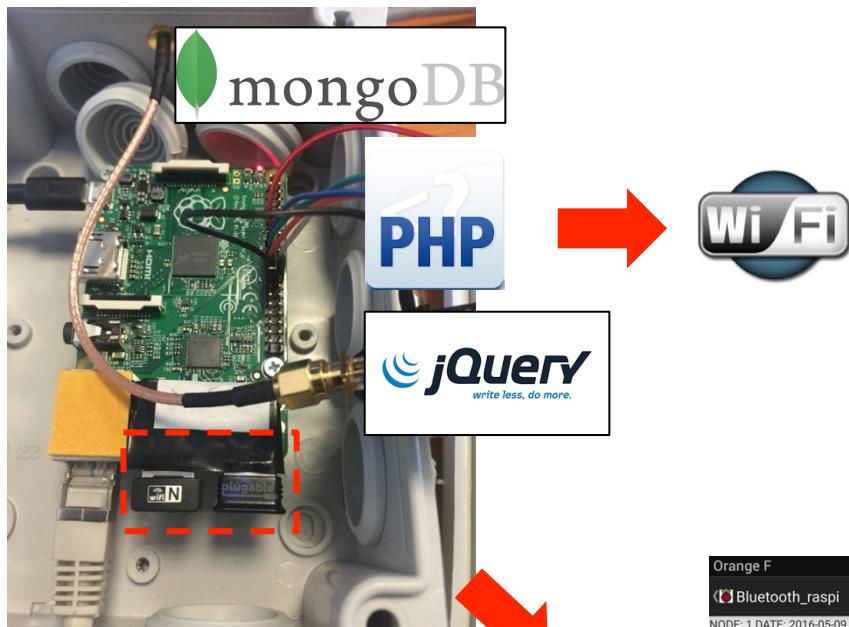
Python scripts
available

<https://github.com/CongducPham/LowCostLoRaGw>

WORKING WITHOUT INTERNET ACCESS



STANDALONE GATEWAY



NOW DEMO TIME!

