

# BUILDING YOUR LOW-COST IOT PLATFORMS & DEMO OF ((WAZIUP)) LONG-RANGE IOT PLATFORM

ISPACE, ACCRA, GHANA  
JUNE 17TH, 2016

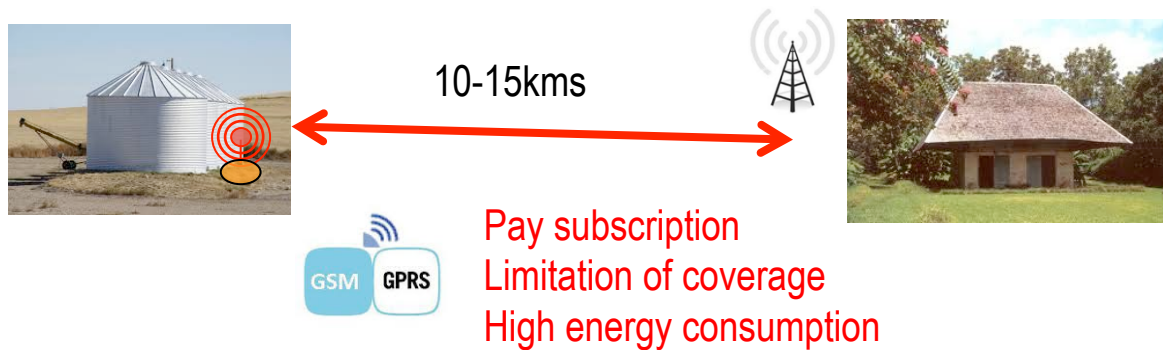


PROF. CONGDUC PHAM  
[HTTP://WWW.UNIV-PAU.FR/~CPHAM](http://www.univ-pau.fr/~cpham)  
UNIVERSITÉ DE PAU, FRANCE

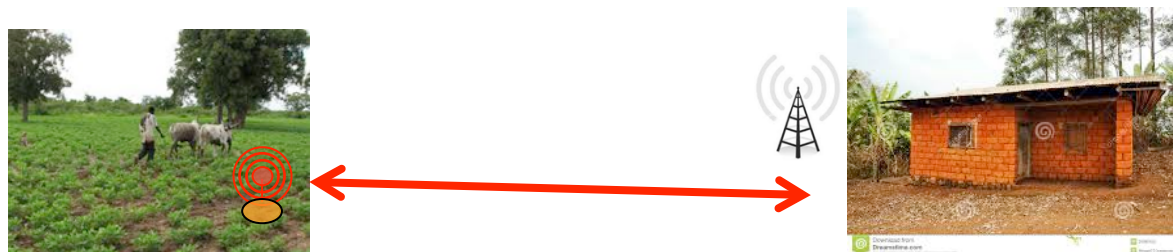


# RURAL SENSING APPLICATIONS

Moisture/  
Temperature  
of storage  
areas

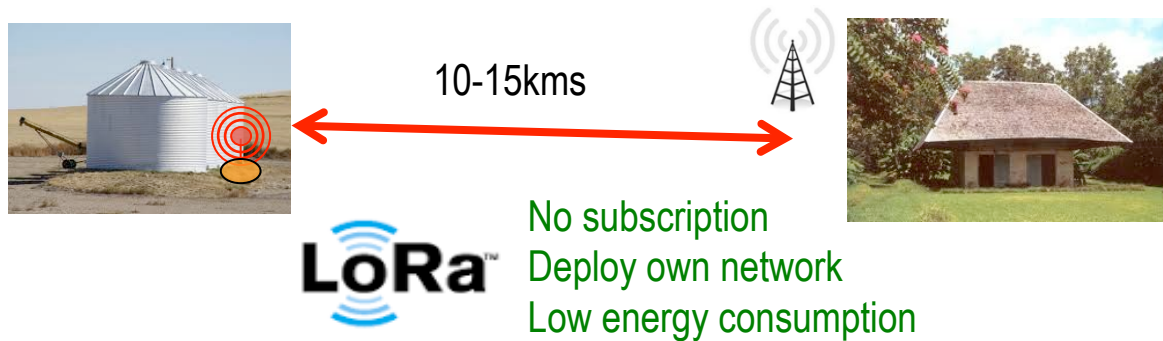


Soil  
parameters  
such as soil  
humidity

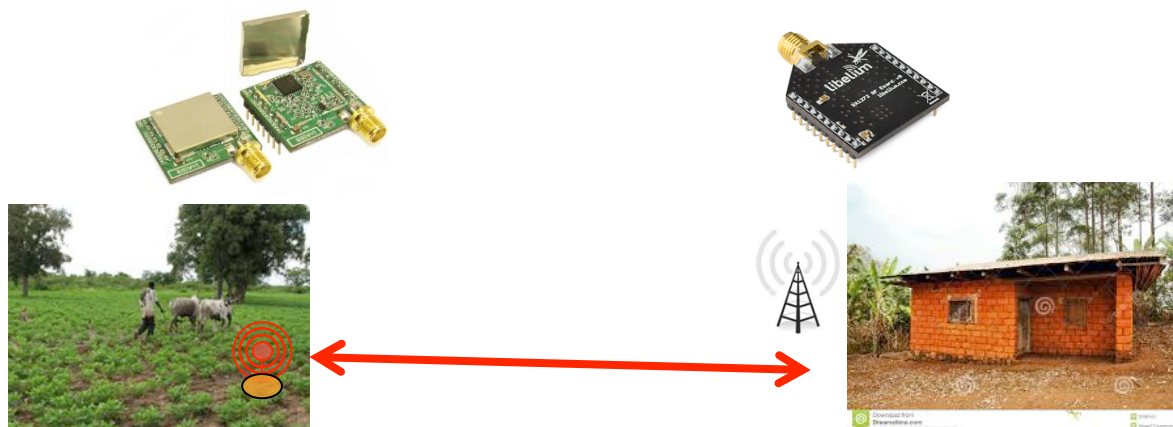


# RURAL SENSING APPLICATIONS

Moisture/  
Temperature  
of storage  
areas



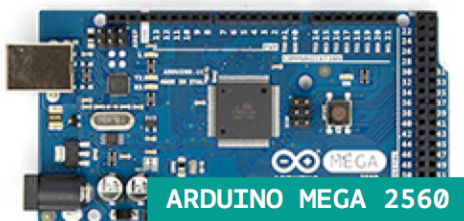
Soil  
parameters  
such as soil  
humidity



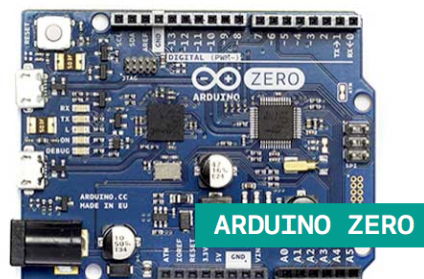
# BUILDING YOUR IOT DEVICE



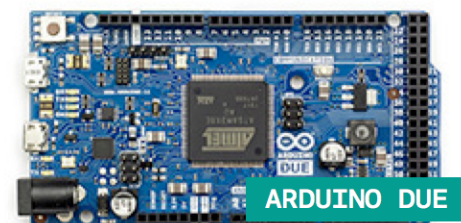
ARDUINO UNO



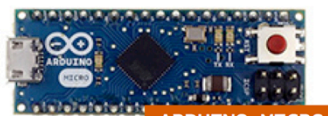
ARDUINO MEGA 2560



ARDUINO ZERO



ARDUINO DUE



ARDUINO MICRO



ARDUINO PRO MINI



ARDUINO NANO



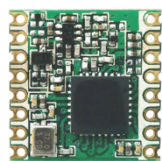
Ideeatron Nexus



Teensy3.1/3.2



LoRa radios that our library already supports



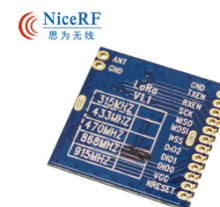
HopeRF  
RFM92W/95W



Libelium LoRa



Modtronix  
inAir9/9B



LoRa1276  
NiceRF  
LoRa1276

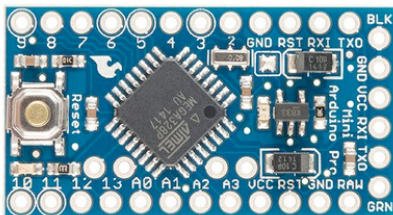
Long-Range communication library



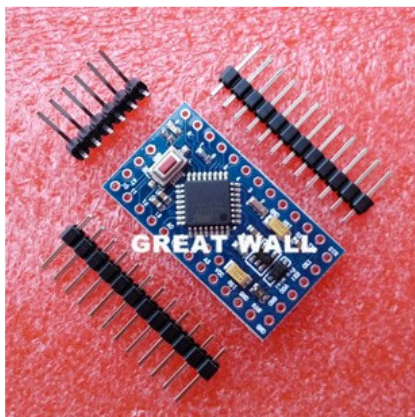
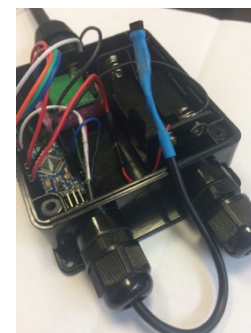
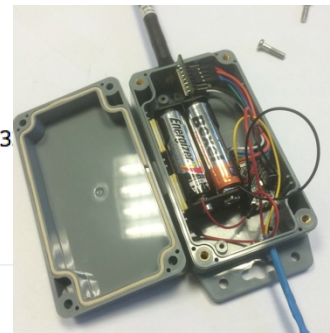
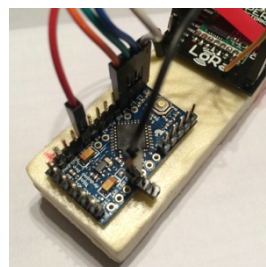
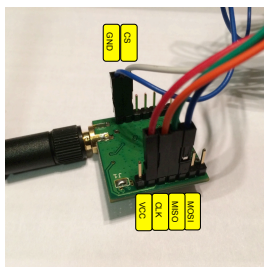
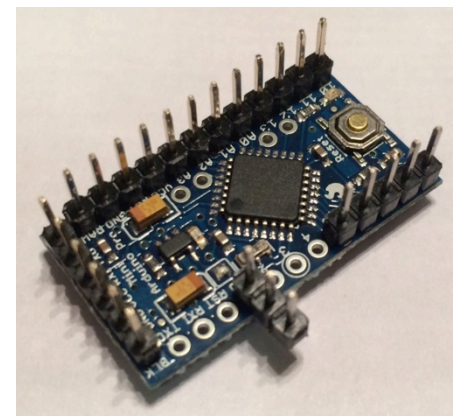
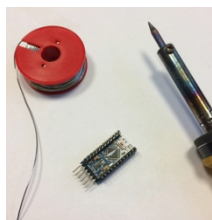
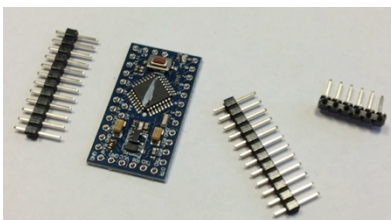


# THE ARDUINO PRO MINI

## Arduino Pro Mini



3.3v and 8MHz version



Avec la bootloader 1 pcs Pro Mini ATMEGA328 Pro Mini 3 MHz pour Arduino

[View original title in English](#)

★★★★★ 4.9 (417 Votes) | 434 Commandes

Prix : € 1,49 / Kit

Trouvez plus de deals sur l'App ▾

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

Quantité :  Kit (55350 Kits available)

Montant total : € 1,78

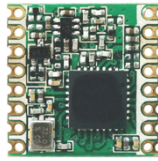
Acheter maintenant

Ajouter au panier





LoRa radios that  
our library already  
supports



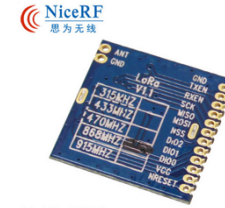
HopeRF  
RFM92W/95W



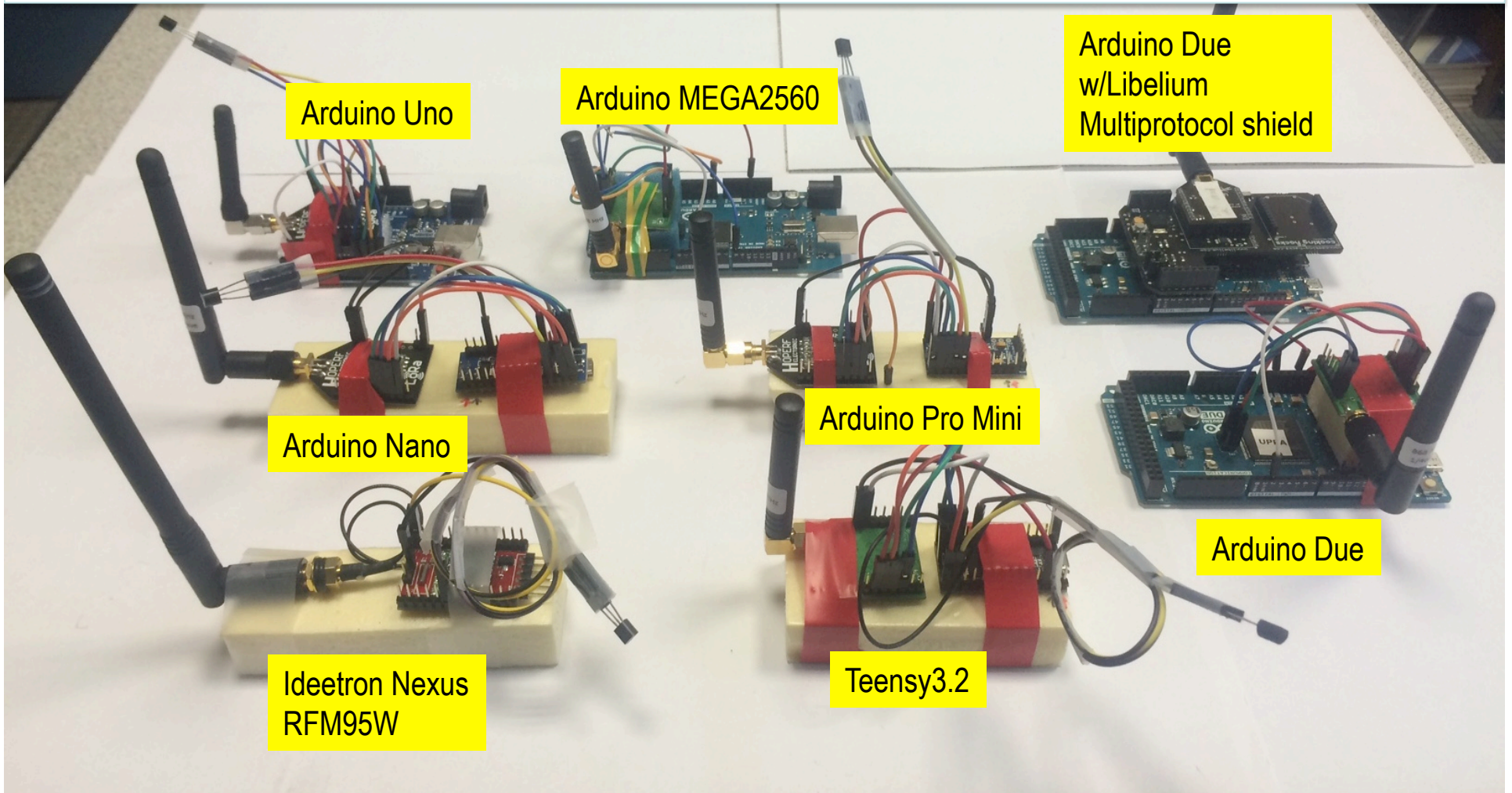
Libelium LoRa



Modtronix  
inAir9/9B

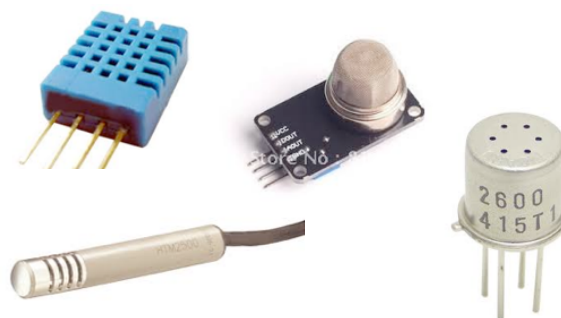


LoRa1276  
NiceRF  
LoRa1276

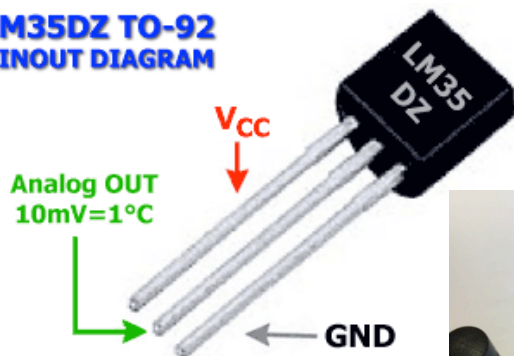




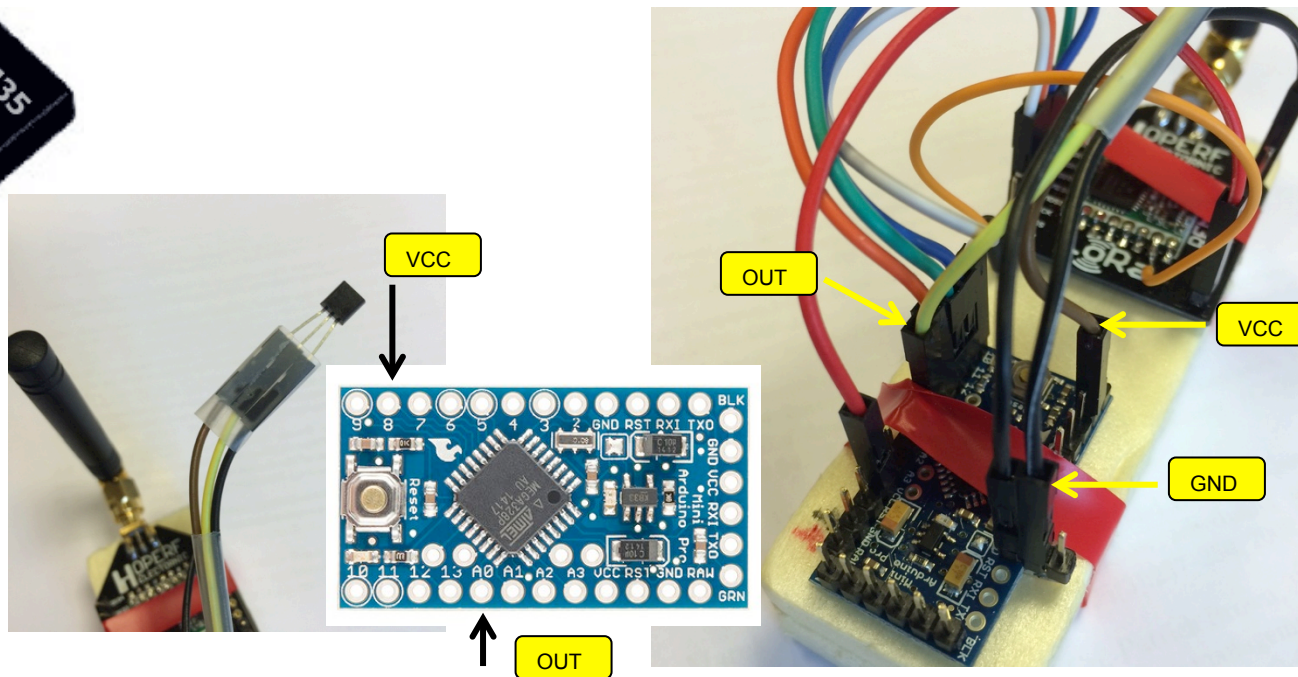
# CONNECTING A SENSOR



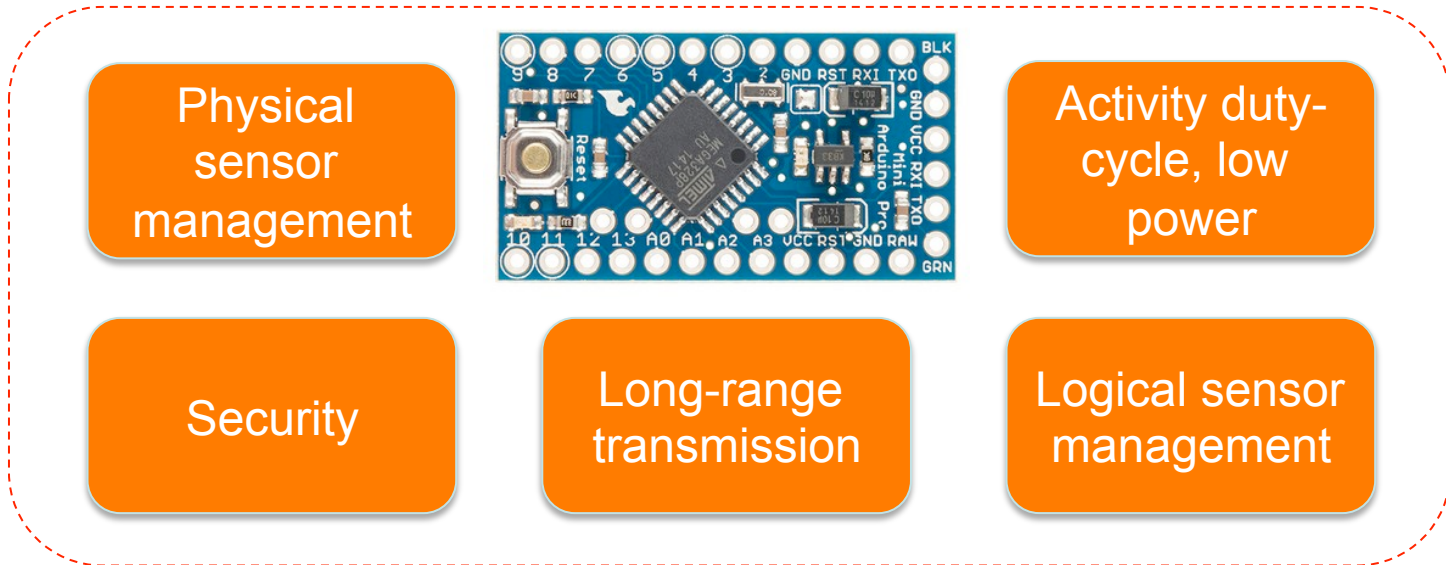
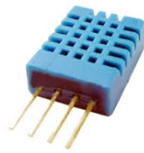
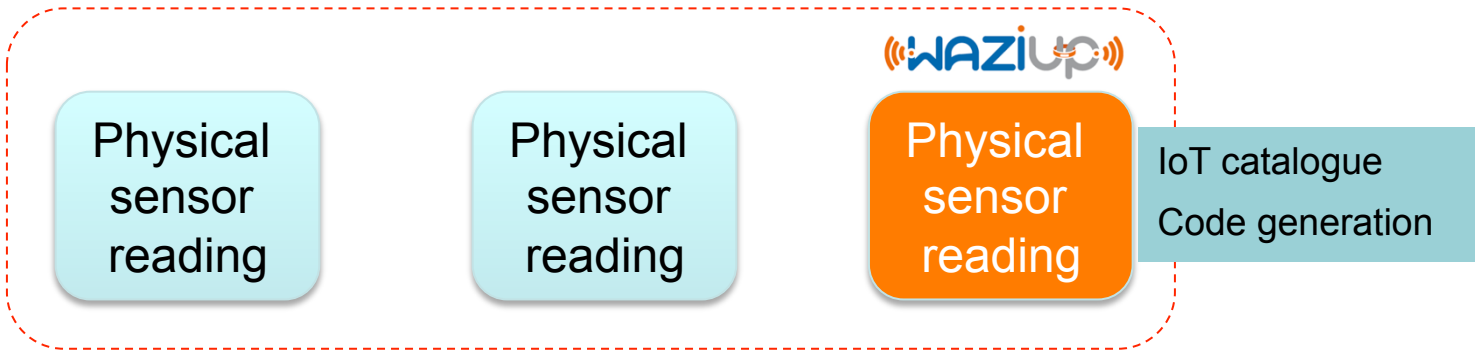
LM35DZ TO-92  
PINOUT DIAGRAM



[www.Vcc2GND.com](http://www.Vcc2GND.com)



# READY-TO-USE TEMPLATES

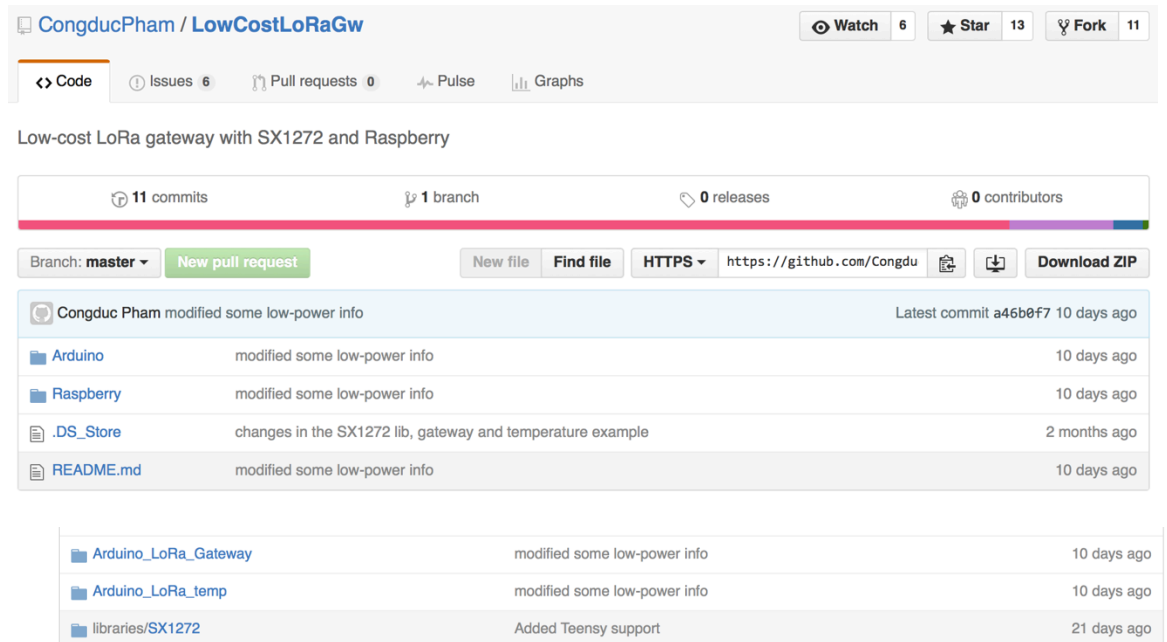


# GETTING THE SOFTWARE



```

Arduino_LoRa_temp
*
* temperature sensor on analog 8 to test the LoRa gateway
*
* Copyright (C) 2015 Congduc Phan, 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 this 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 M0RF
* // boards we set the initial power
* //
* // uncomment if your radio is an M0RF
* #define RADIO_RF92_95
* // uncomment if your radio is a M0RF
* // #define RADIO_SX1272
*
* // IMPORTANT
    
```



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/CongducPham/ LowCostLoRaGw Download ZIP

Congduc Pham modified some low-power info 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).

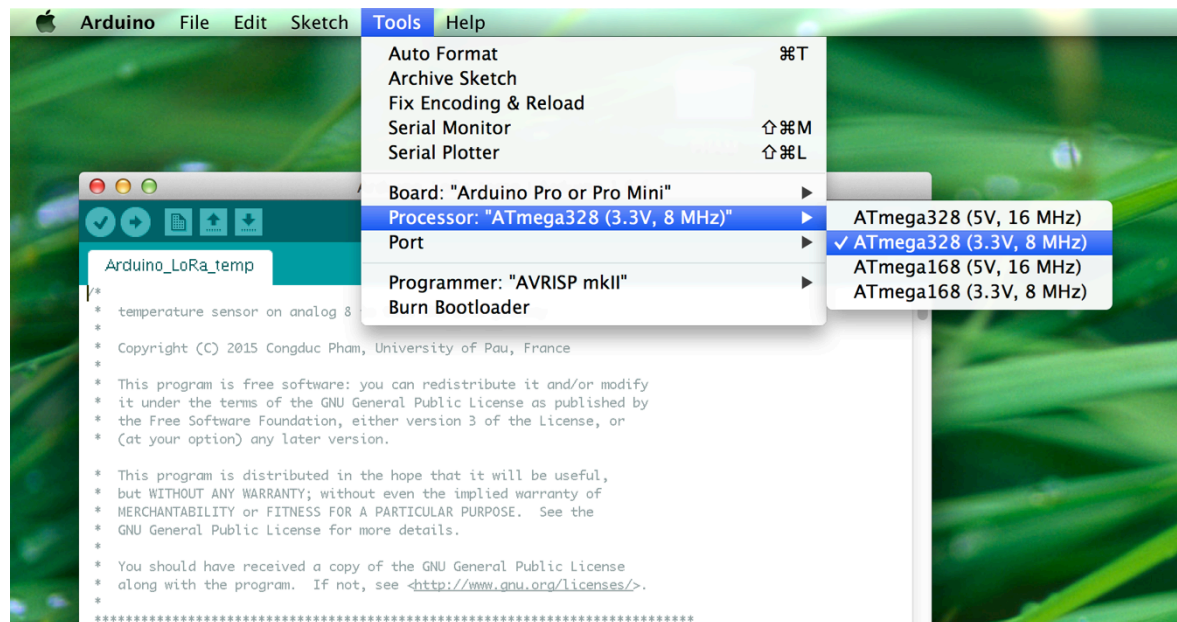
Get into the Arduino folder and get both Arduino\_LoRa\_temp and SX1272 folder. Copy Arduino\_LoRa\_temp into your "sketch" folder and SX1272 into "sketch/libraries"





# COMPILING

```
Arduino_LoRa_temp | Arduino 1.6.6
Arduino_LoRa_temp
/*
 * temperature sensor on analog 8 to test the LoRa gateway
 * Copyright (C) 2015 Congduc Phan, 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 Modtronix board use the PA_BOOST pin and not the RF0. Therefore, for these
// boards we set the initial power to 'x' and not 'M'. This is the purpose of the define statement
//
// uncomment if your radio is an HopeRF RFM92K or RFM95K
#define RADIO_RF92_95
// uncomment if your radio is a Modtronix inA1r9B (the one with +20dBm features), if inA1r9, leave comment
// #define RADIO_INA1R9B
// *****
// IMPORTANT
Teensy 3.2 / 3.1. Serial, 72 MHz optimized, US English on /dev/cu.usbmodem1-433801
```

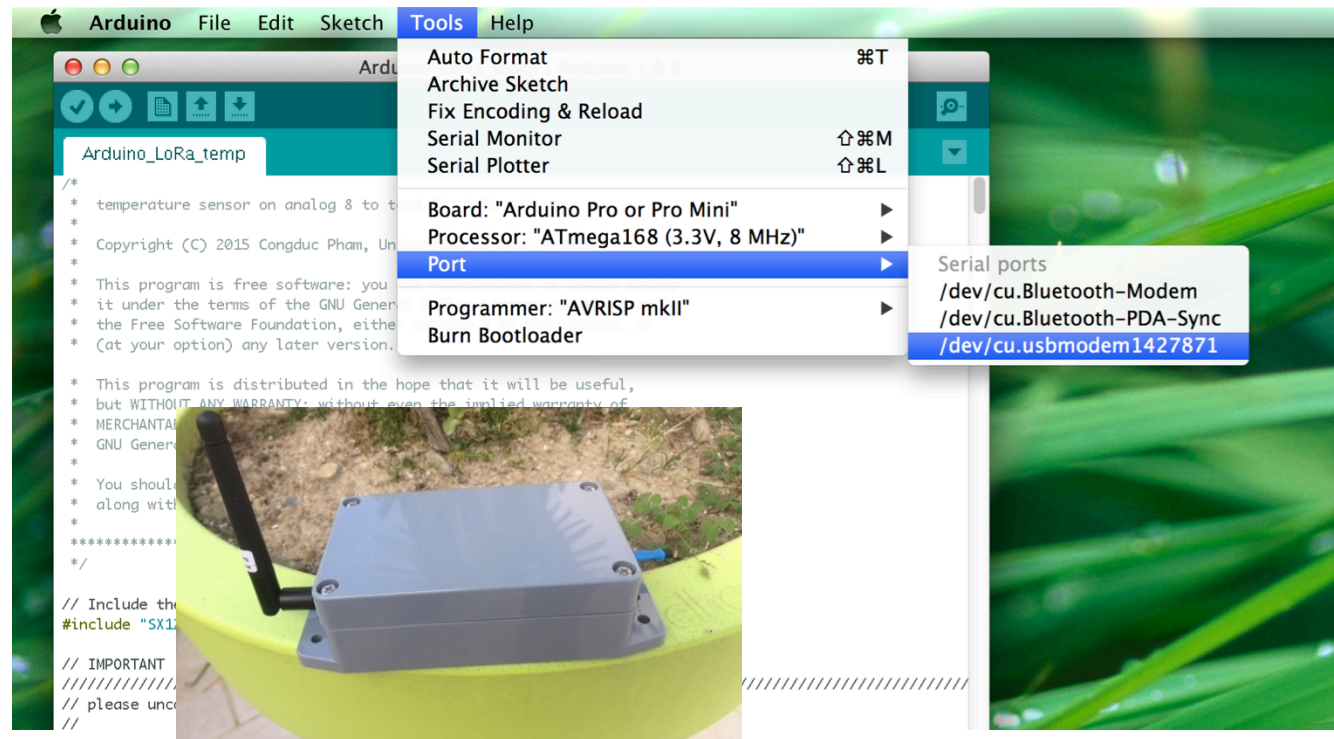
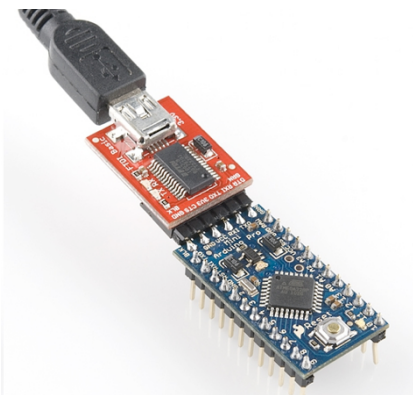


Open the Arduino\_LoRa\_temp sketch and select the Arduino Pro Mini board with its 3.3V & 8MHz version.

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

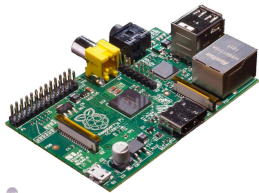


## NEED A GATEWAY!

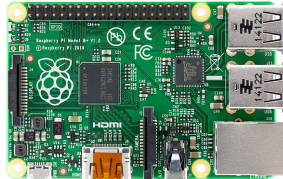


# BUILDING YOUR IOT GATEWAY

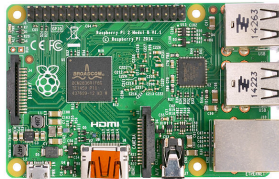
RPI v1 model B



RPI v1 model B+



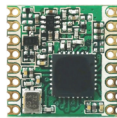
RPI v2 model B



RPI v3 model B



LoRa radios that our library already supports



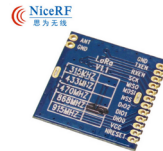
HopeRF  
RFM92W/95W



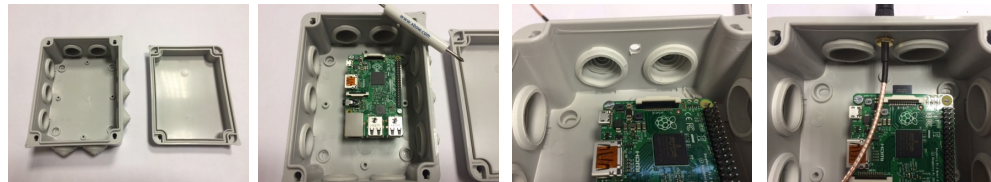
Libelium LoRa



Modtronix  
inAir9/9B

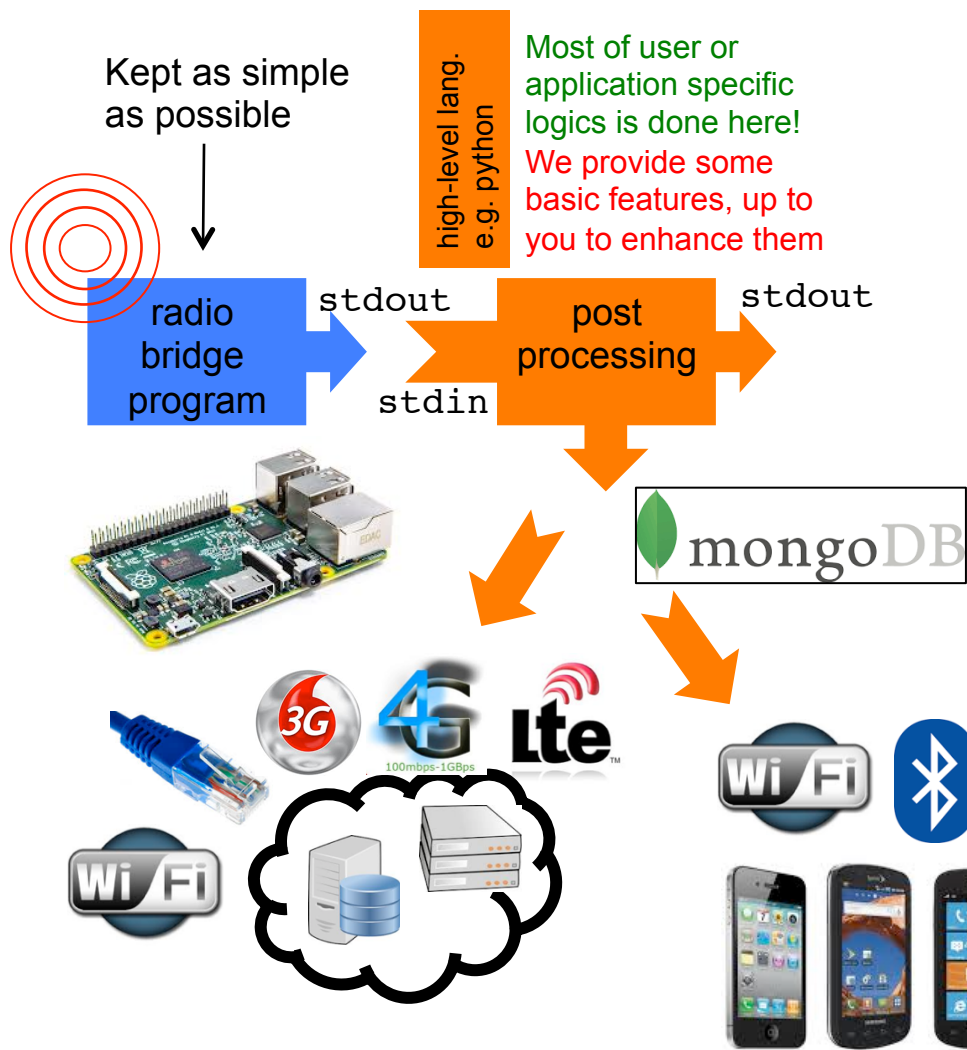


LoRa1276  
NiceRF  
LoRa1276





# OUR LOW-COST GATEWAY ARCHITECTURE



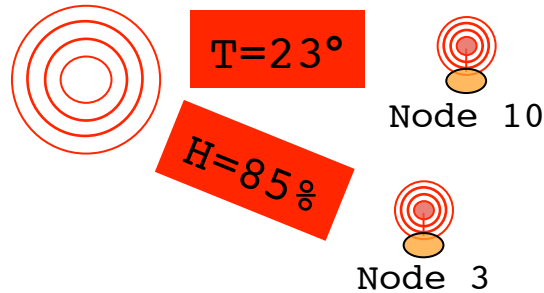
post-processing	user/app-specific
lora_gateway program	
Long-range radio lib	
ArduPi lib	
Raspbian	







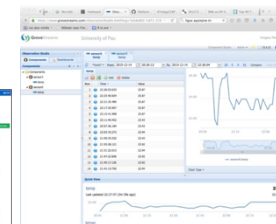
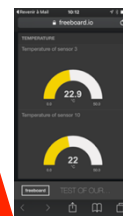
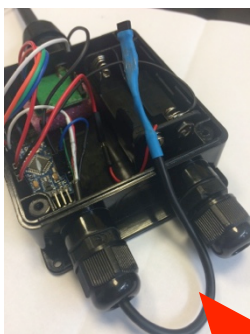
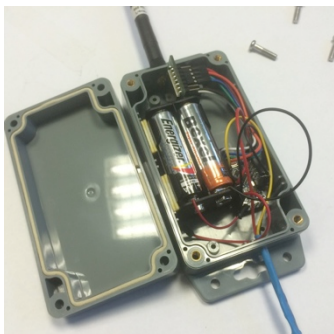
# STARTING THE BASIC GATEWAY



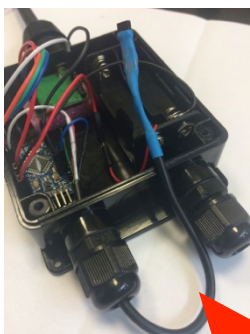
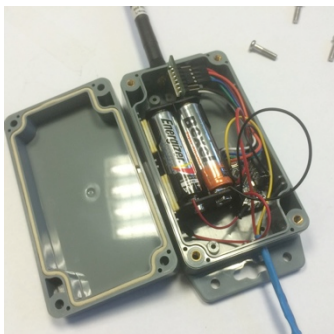
```
> sudo ./lora_gateway
Power ON: state 0
LoRa mode: 4
Setting mode: state 0
Channel CH_10_868: state 0
Power M: state 0
Get Preamble Length: state 0
Preamble Length: 8
LoRa addr 1 : state 0
SX1272/76 configured as LR-BS. Waiting RF input for transparent RF-serial bridge

--- rxlor. dst=1 type=0x10 src=10 seq=0 len=5 SNR=9 RSSIpkt=-54
^p1,16,10,0,5,9,-54
T=23°
--- rxlor. 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 !

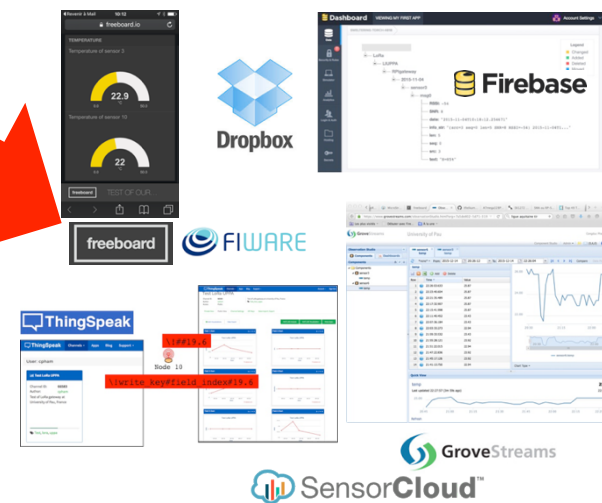


Step-by-step tutorial and source code available



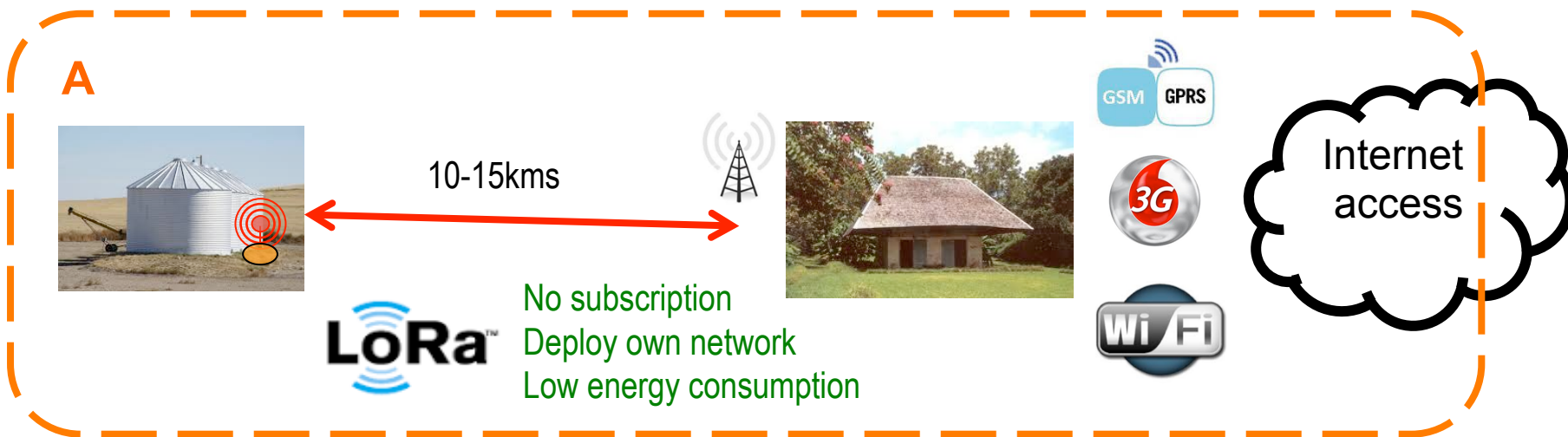
Step-by-step tutorial and source code available

Python scripts available



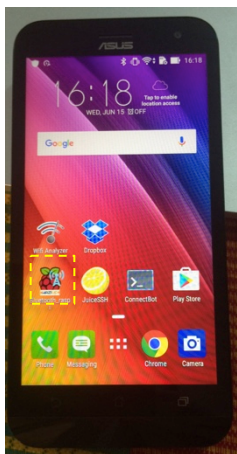
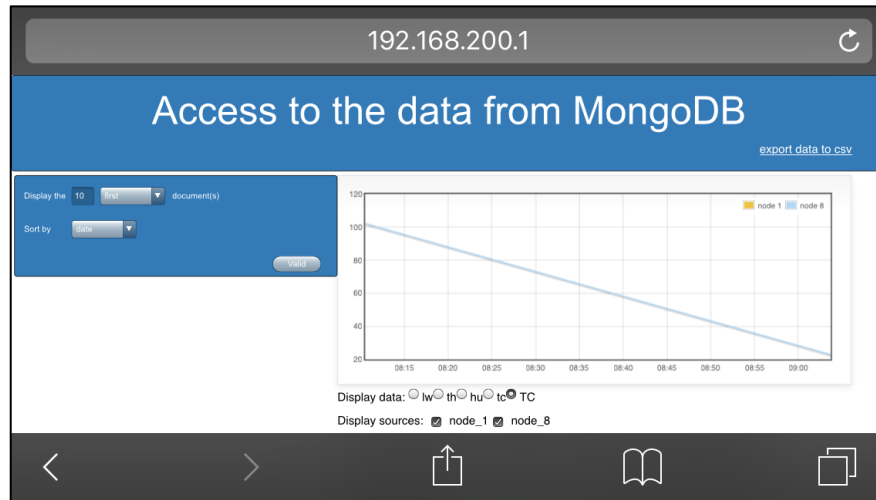
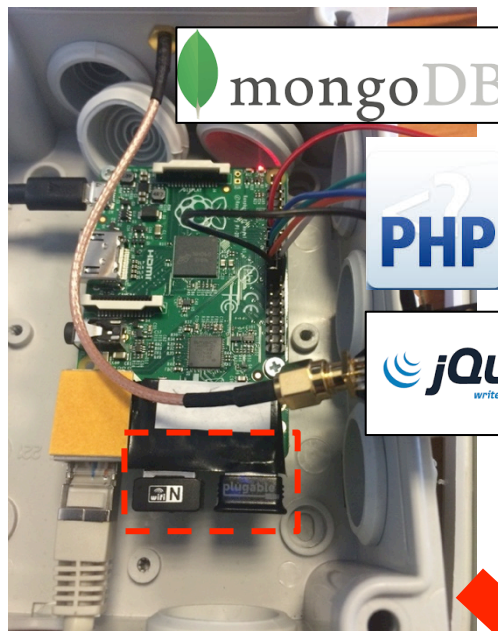
<https://github.com/CongducPham/LowCostLoRaGw>

# WORKING WITHOUT INTERNET ACCESS





# STANDALONE GATEWAY



Orange F Bluetooth\_raspi

```

NODE: 1 DATE: 2016-05-09 08:04:59.807000 DATA: ("lw": 3.29, "th": 22.6, "hu": 50.7)
NODE: 1 DATE: 2016-05-09 08:28:52.993000 DATA: ("lw": 3.29, "th": 22.89, "hu": 50.29)
NODE: 1 DATE: 2016-05-09 08:53:04.317000 DATA: ("lw": 3.29, "th": 23.2, "hu": 50.79)
NODE: 1 DATE: 2016-05-09 09:05:00.997000 DATA: ("lw": 3.29, "th": 23.29, "hu": 51.29)
NODE: 1 DATE: 2016-05-09 09:17:24.482000 DATA: ("lw": 3.29, "th": 23.39, "hu": 51.7)
NODE: 1 DATE: 2016-05-09 09:41:27.437000 DATA: ("lw": 3.29, "th": 23.6, "hu": 52.0)
NODE: 1 DATE: 2016-05-09 10:05:39.032000 DATA: ("lw": 3.29, "th": 23.79, "hu": 51.5)
NODE: 1 DATE: 2016-05-09 10:17:45.186000 DATA: ("lw": 3.29, "th": 23.79, "hu": 50.79)
NODE: 1 DATE: 2016-05-09 10:29:24.285000 DATA: ("lw": 3.29, "th": 23.79, "hu": 50.79)
NODE: 1 DATE: 2016-05-09 10:53:09.347000 DATA: ("lw": 3.29, "th": 23.79, "hu": 51.9)
NODE: 1 DATE: 2016-05-09 11:17:02.953000 DATA: ("lw": 3.29, "th": 23.5, "hu": 50.79)
NODE: 1 DATE: 2016-05-09 11:52:53.334000 DATA: ("lw": 3.29, "th": 23.29, "hu": 50.7)
NODE: 1 DATE: 2016-05-09 12:04:32.437000 DATA: ("lw": 3.29, "th": 23.5, "hu": 50.29)
NODE: 1 DATE: 2016-05-09 12:16:56.116000 DATA: ("lw": 3.29, "th": 23.6, "hu": 50.9)
    
```

Display data    Retrieve data in a csv file

Orange F Bluetooth\_raspi

NODES PREFERENCES

1 check to retrieve its data

8 check to retrieve its data

DATES PREFERENCES

Pick a begin date  
Retrieve data since 09-05-2016

Pick an end date  
Retrieve data until 17-05-2016

Display data    Retrieve data in a csv file

Orange F Bluetooth\_raspi

Creating csv file with the data received...  
File 17-05-2016\_10h39m36s.csv created and saved in the folder /storage/emulated/0/Raspberry\_local\_data

Display data    Retrieve data in a csv file



**NOW DEMO TIME!**

