

DESIGNING AND DEPLOYING LOW-COST IOT IN AFRICA

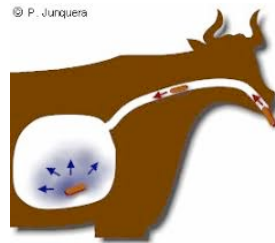
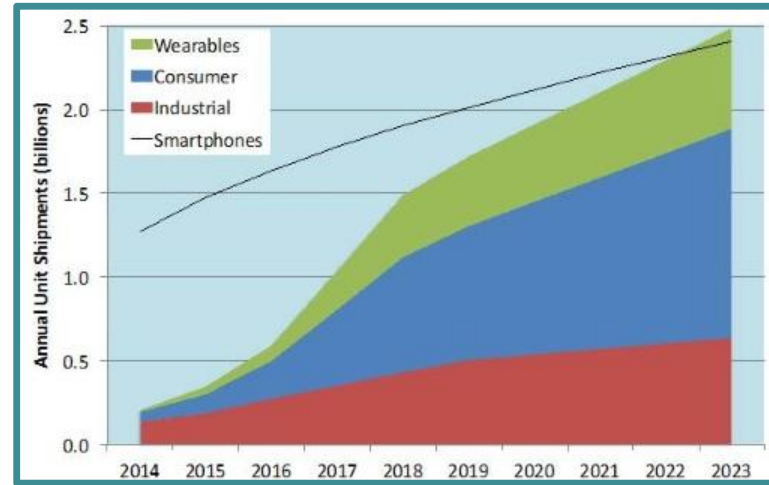
ITU World Summit on the Information Society (WSIS)
April 8-12th, 2019
ITU Headquarters, Geneva, Switzerland



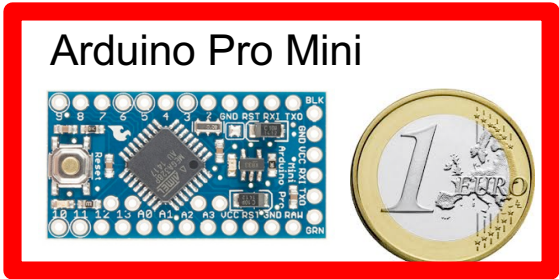
Prof. Congduc Pham
<http://www.univ-pau.fr/~cpham>
Université de Pau, France



Maturation of the IoT ecosystem



Low cost hardware



Arduino Pro Mini



LoPy

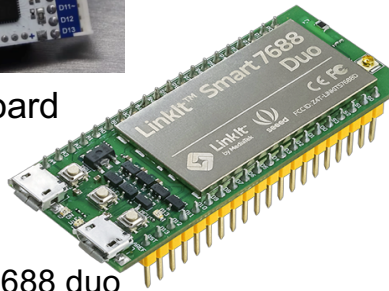
<http://blog.atmel.com/2015/12/16/rewind-50-of-the-best-boards-from-2015/>

<http://blog.atmel.com/2015/04/09/25-dev-boards-to-help-you-get-started-on-your-next-iot-project/>



ATmega328P 3.3v
8bit, 8MHz, 32K flash, 2K RAM

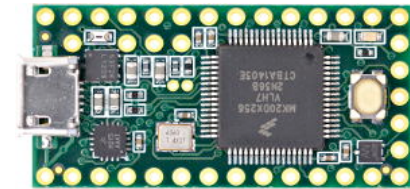
Theairboard



LinkIt Smart7688 duo



Expressif ESP32



Teensy 3.2



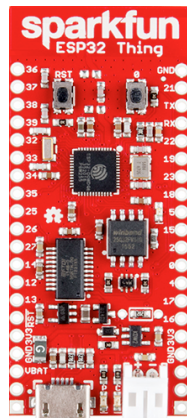
STM32 Nucleo-32



Heltec ESP32 + OLED



Adafruit Feather



Sparkfun ESP32 Thing



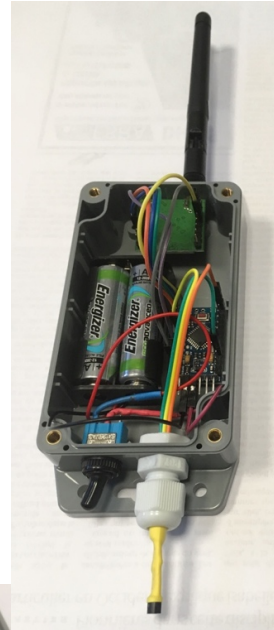
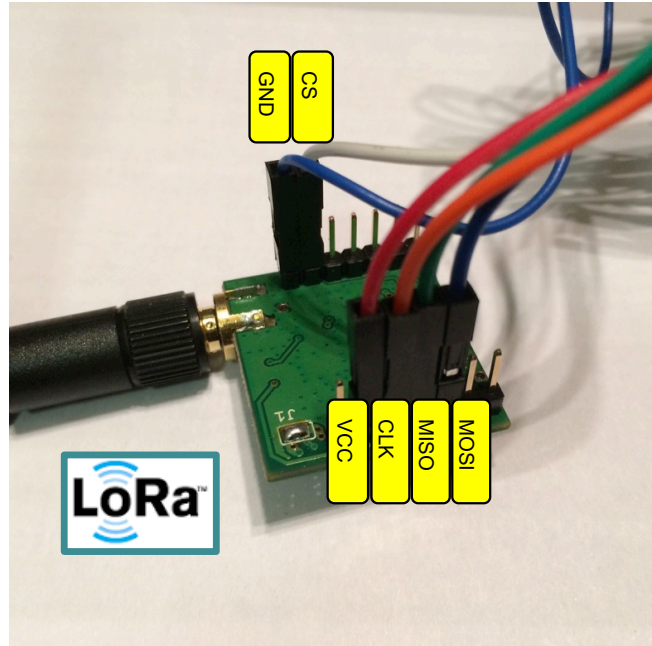
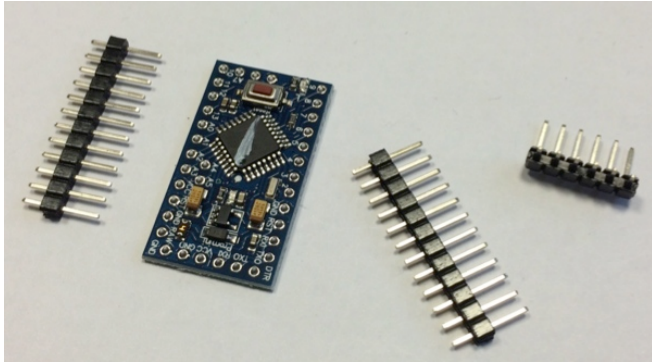
Tessel

SodaqOnev2

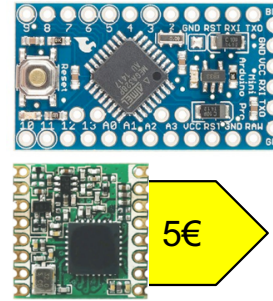
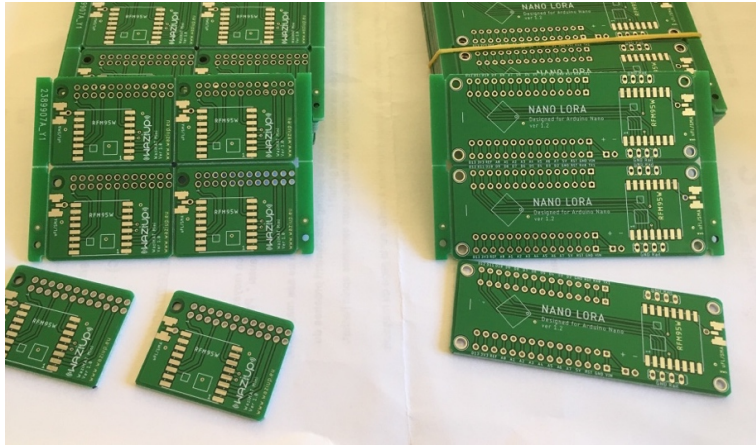


Tinyduino

From full Do-It-Yourself approach



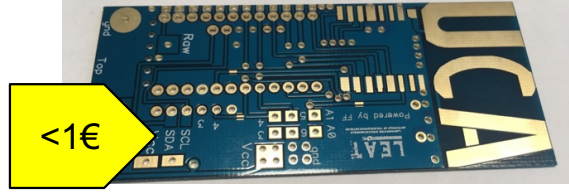
To simple PCB for easy integration



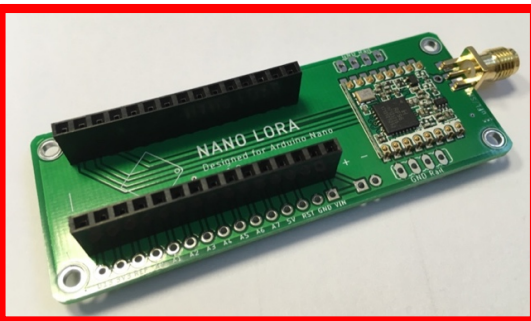
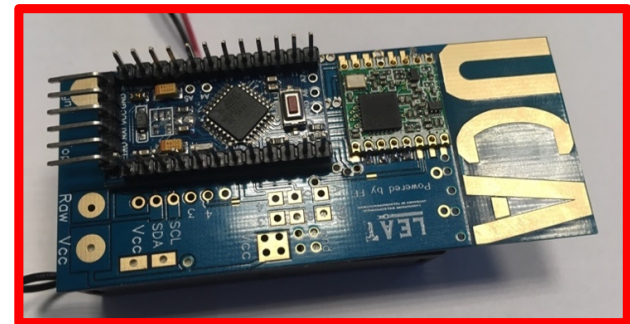
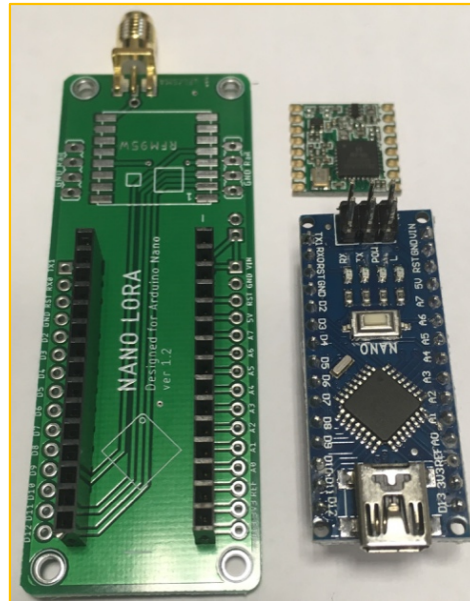
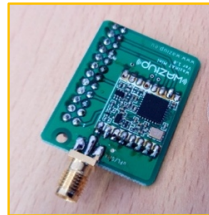
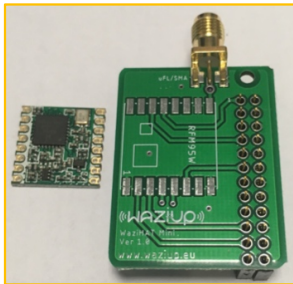
1.5€

5€

https://github.com/FabienFerrero/UCA_Board



<1€



To close-to-market integration

- WAZIdev board allows for further integration

HOW DOES IT WORK?

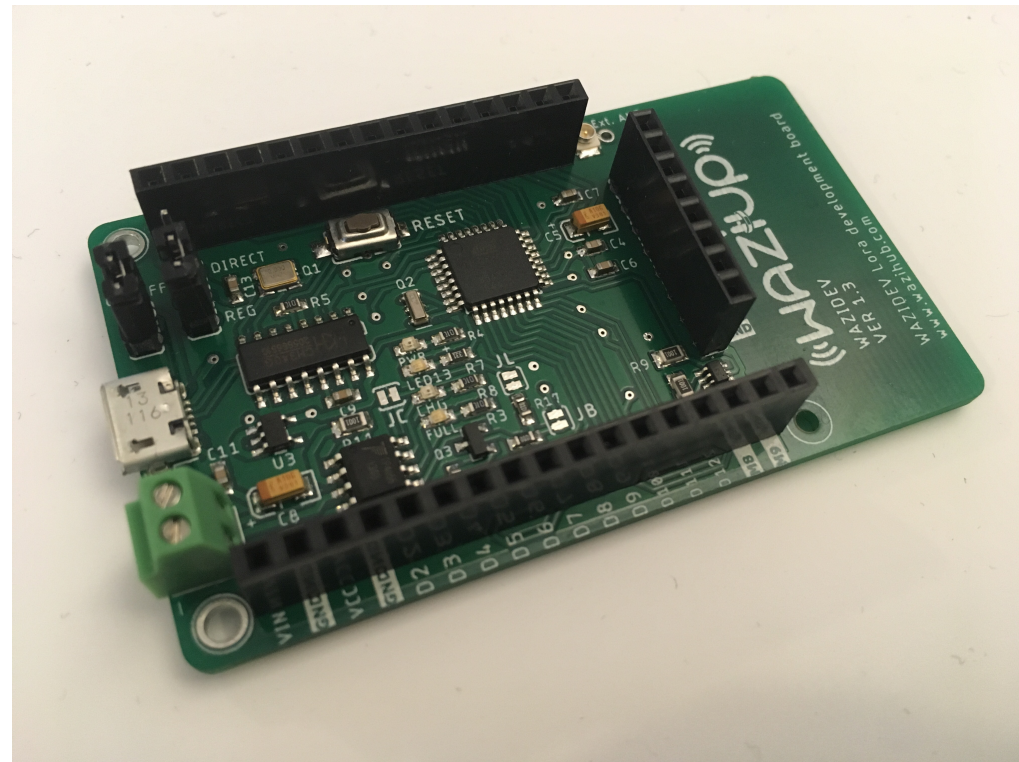
WAZIDEV is a development board with embedded LoRa module that allows the developers to simply develop IoT sensor node as well as IoT actuator node for their IoT applications. Using WAZIUP Gateway and Cloud platform, the developer can develop a range of IoT applications. The board is highly configurable to support wide range of sensors. The board is fully compatible with our technology ecosystem but it is also interoperable and open to integrate with other ecosystems.

WAZIDEV LoRa development board

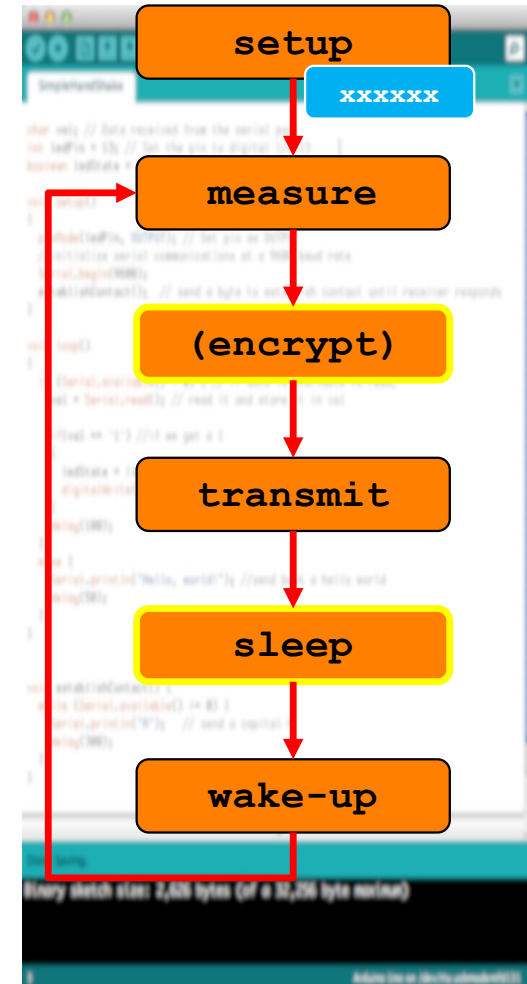
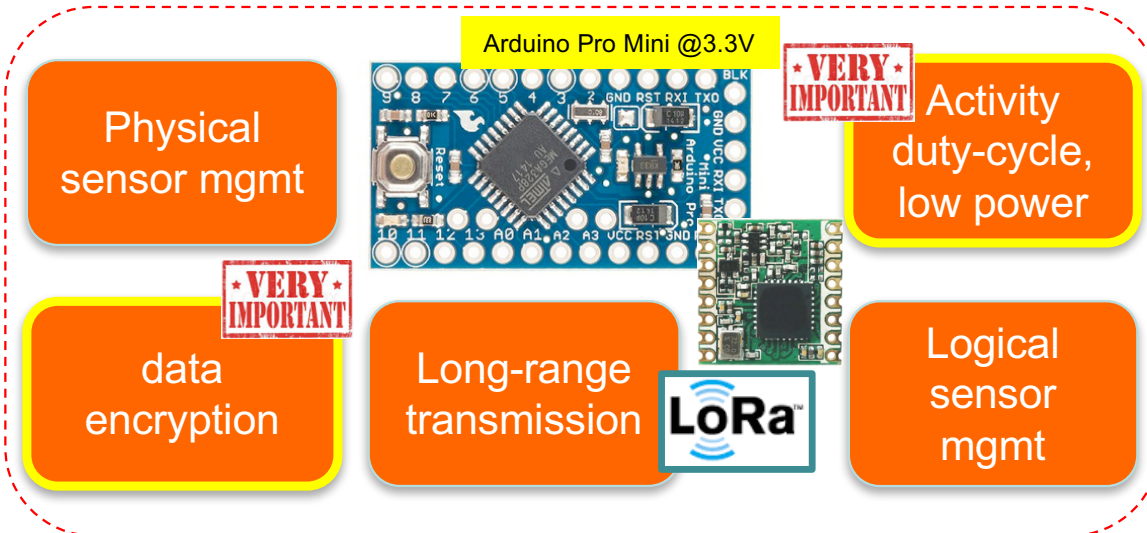
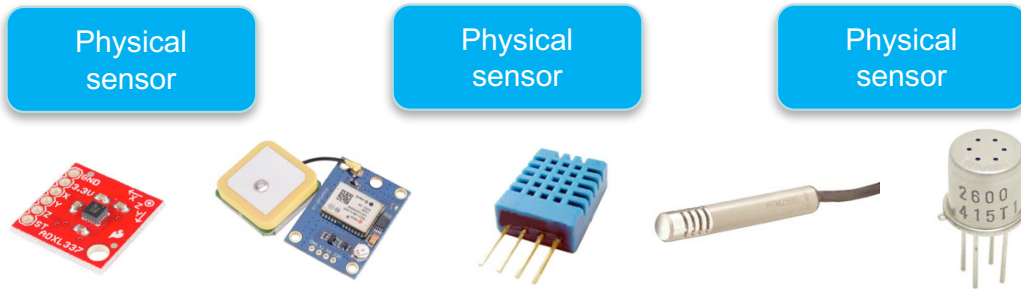
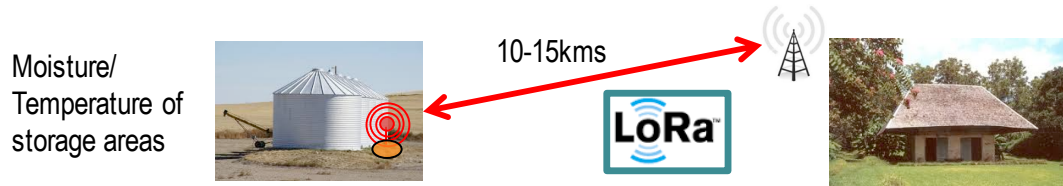
The LoRa sensor board for developing IoT solutions

WAZIDEV offers a **fully-fledged LoRa** development board. It is an ideal solution for start-ups and entrepreneurs who want to rapidly prototype IoT applications.

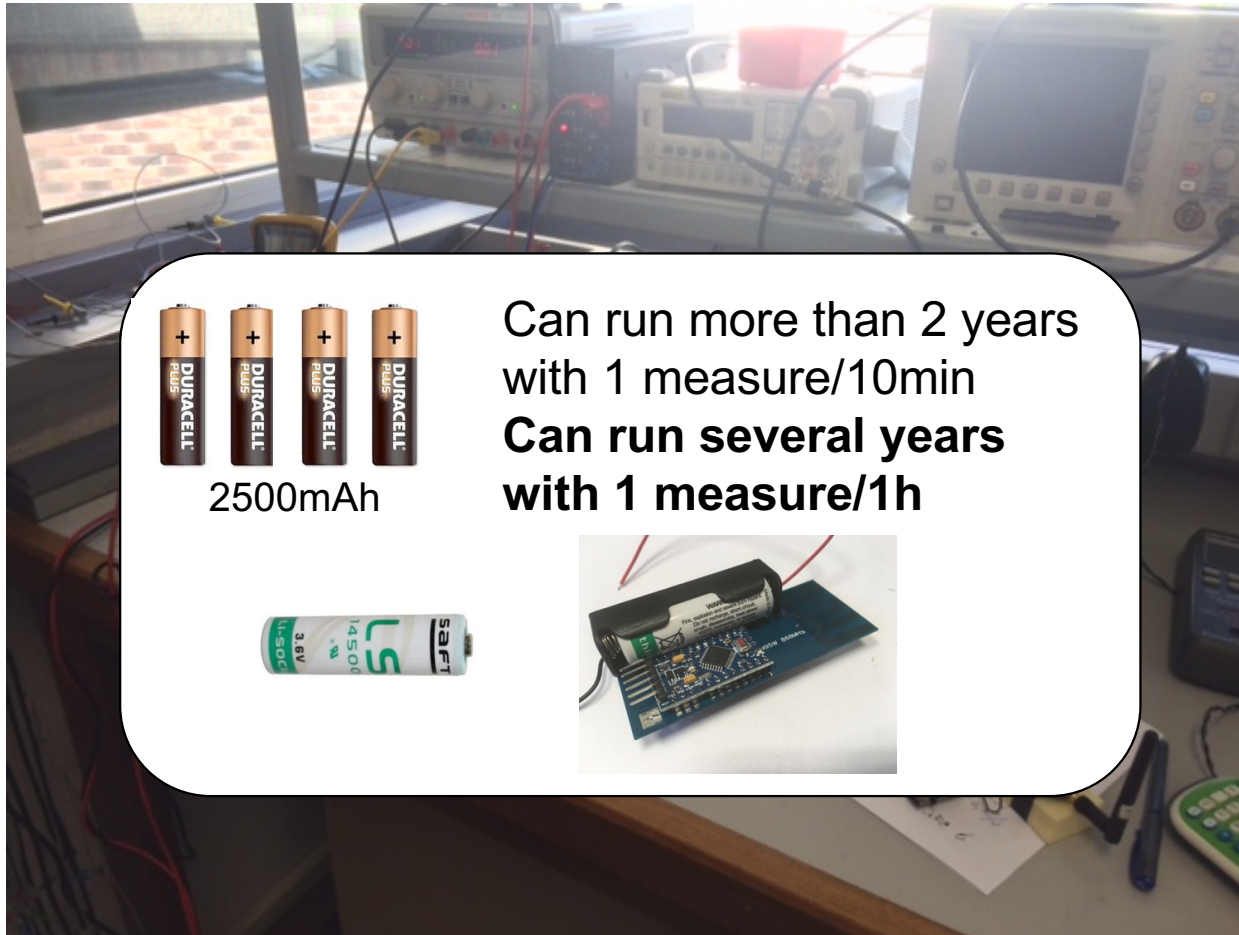
- It supports the Arduino IDE and provide all Arduino standard pins
- Embedded Lipo battery charger for the applications with solar panel
- Two programmable pins with high current support (500mA)
- Low power option and battery level monitoring features



Reduce development cost & time

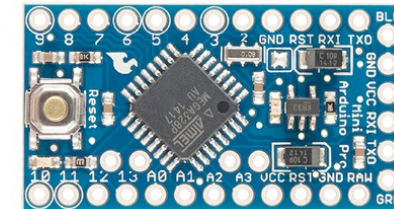


Achieving several years of operation!

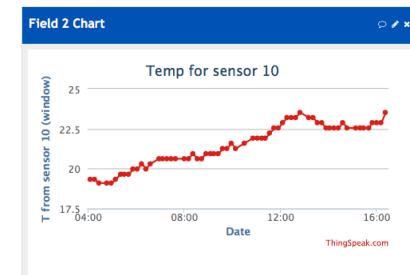


2500mAh

Can run more than 2 years
with 1 measure/10min
**Can run several years
with 1 measure/1h**



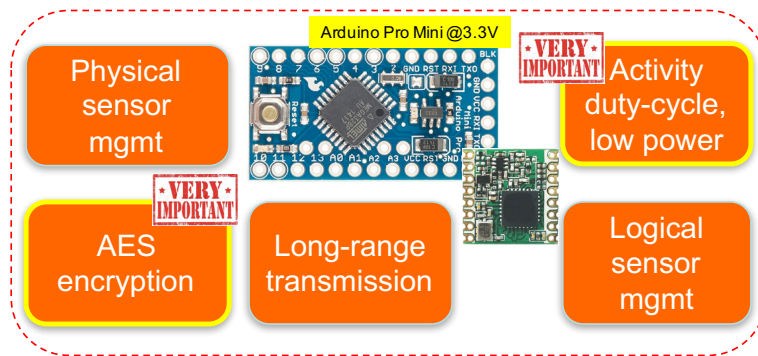
wakes-up every 10min,
take a measure and send
to GW



**5 μ A in deep sleep
mode, about
40mA when active
and sending!**

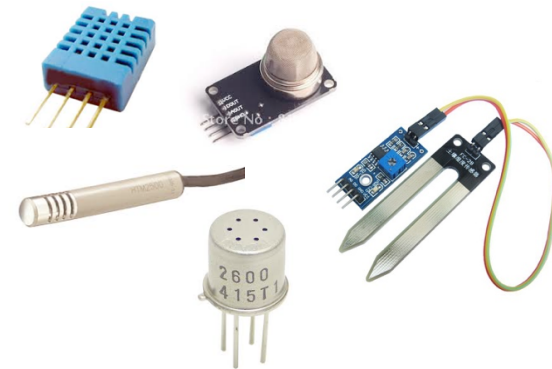
Generic IoT v.s. highly specialized

- Build **low-cost, low-power, generic** IoT platform
- Methodology for low-cost platform design
- Technology transfers to user communities, economic actors, stakeholders,...



+

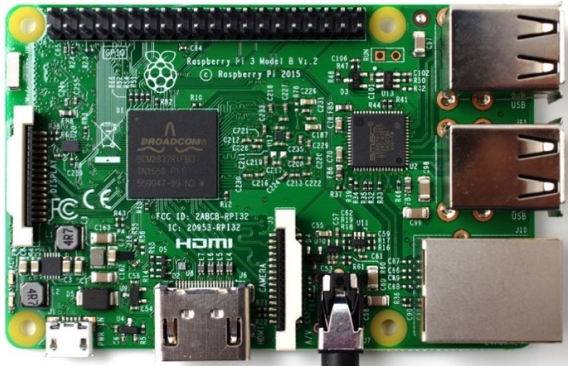
=



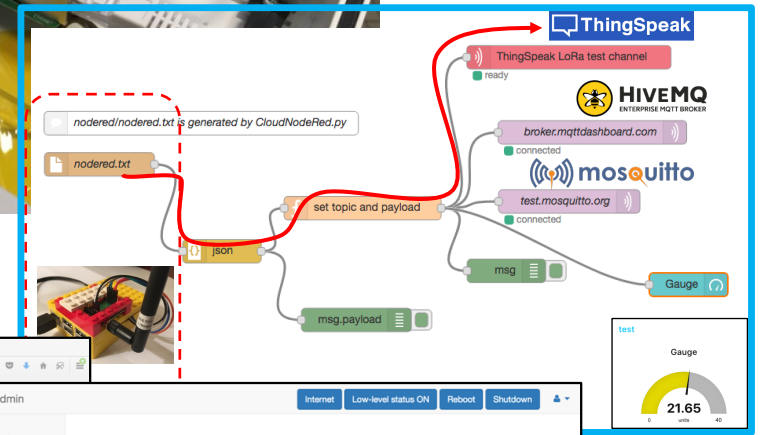


Open, versatile IoT gateway

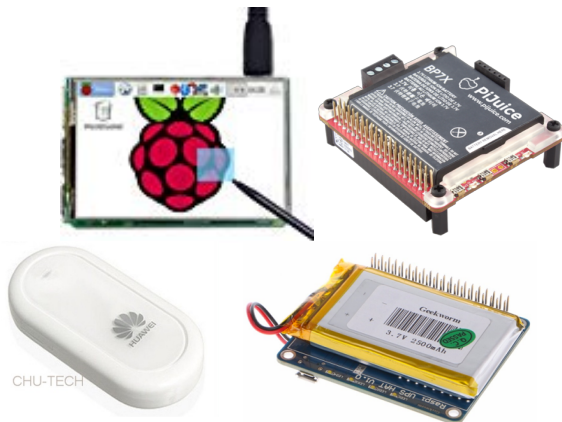
Large customization features



Raspberry Pi: lots of libraries, lots of software, lots of hardware, lots of shields,...



Prof. Congduc Pham
<http://www.univ-pau.fr/~cpham>



Gateway configuration

Mode	1
Frequency	-1
PA_BOOST	Disabled

PA_BOOST is required for some radio modules such as nA98, RFM92W, RFM95W, Nucleo-L432KA
After changing the PA_BOOST settings, run Gateway Update/Basic config to recompile the b

Cloud

Cloud	WAZIUP	ThingSpeak	Cloud No Internet	Cloud Gps File	Cloud MQTT	Cloud Node-RED
Enabled	false	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
project name	waziup	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
organization name	ORG	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
service tree		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
auth token	this_is_my_authorization_token	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
source list	Empty	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



The WAZIUP cloud platform

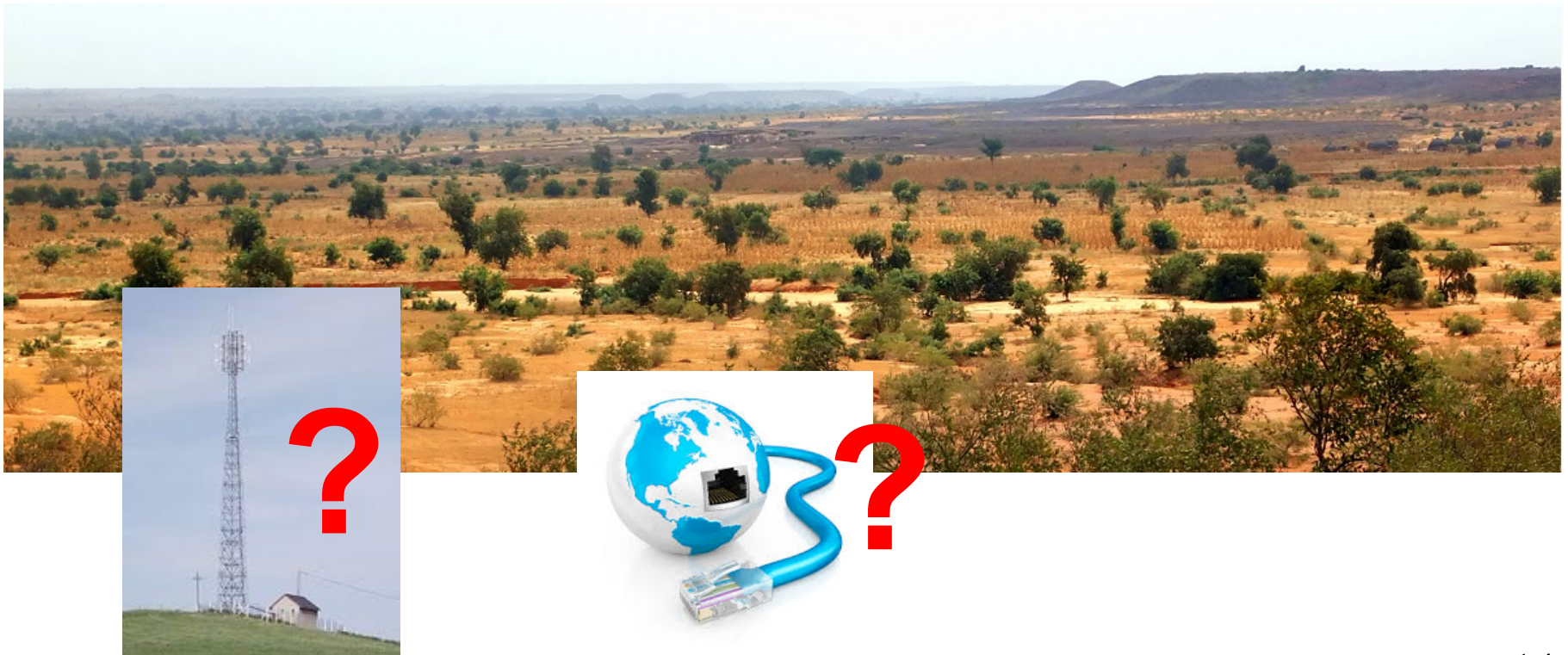
<https://dashboard.waziup.io>



- ⦿ Sensors data and context
- ⦿ Gateway management
- ⦿ Notifications
- ⦿ User management
- ⦿ Responsive design

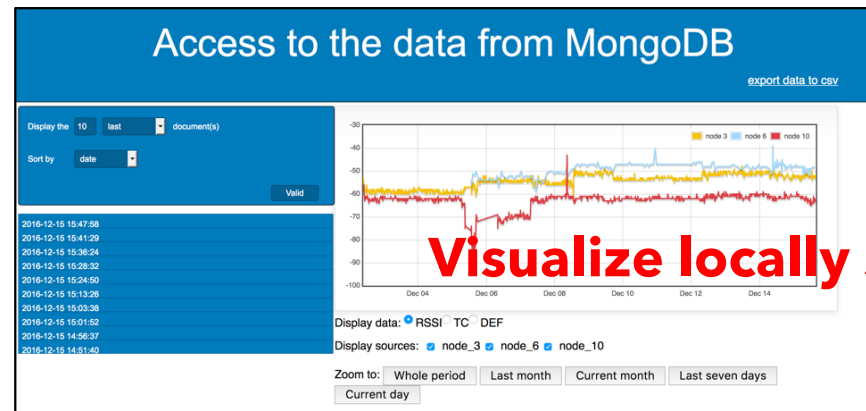
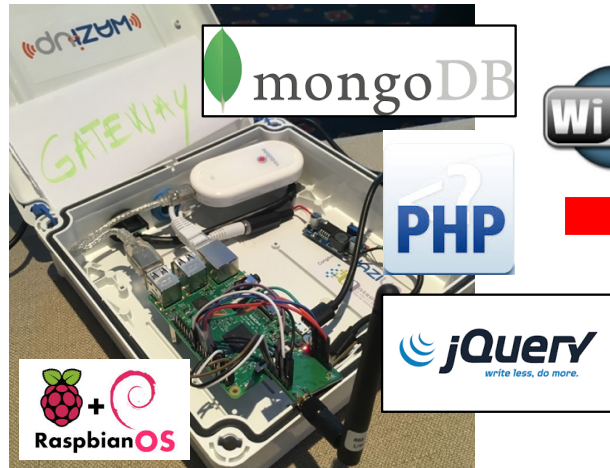
Rural areas: no Internet ☹️

- ⦿ deploying IoT in very isolated areas...
- ⦿ ... where internet and electricity are not stable!

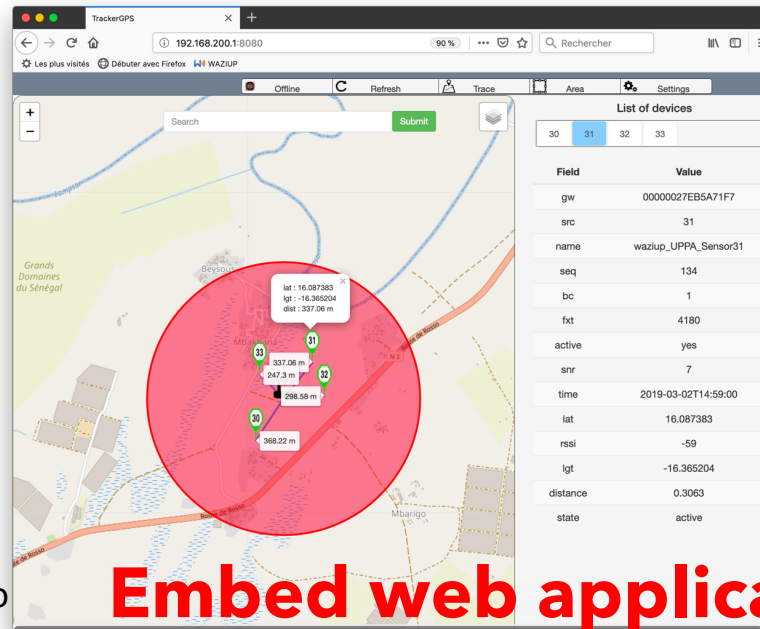
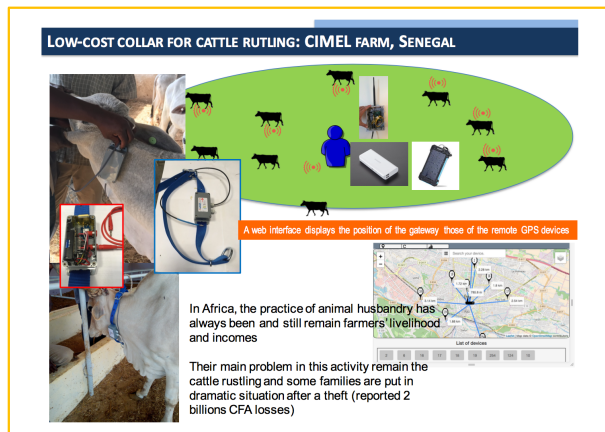


Autonomous gateway

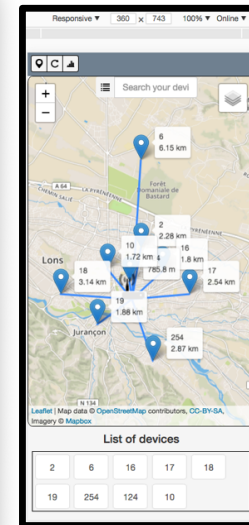
Embedding applications



Visualize locally stored data



Embed web applications



Link to a short demo video of the collar web interface: <https://youtu.be/meFDav1SLPI>

**LOW-COST LORA IOT DEVICE:
A STEP-BY-STEP TUTORIAL**

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

YouTube

Congduc Pham, <http://cpham.perso.univ-pau.fr>

<http://www.waziup.eu>

The generic hardware platform

The Arduino Pro Mini

The Arduino Pro Mini is a compact form factor Arduino board based on the ATmega328P microcontroller. Use the **3.3v and 8MHz version** of the Arduino Pro Mini for lower power consumption.

You can get the original board designed by Sparkfun or get one of the various clones available mainly from Chinese manufacturer. The last solution is very cost-effective as the Pro Mini board can be purchased for a bit more than 1€ a piece.

Depending on how many sensors you want to connect, the number of ground (GND) pins may be limited. You can extend a GND pin with a header pin where all pins are soldered together.

The LoRa radio module

There are various LoRa radio modules that are all based on the Semtech SX1272/1276 chips family.

Fully tested LoRa radio modules

HopeRF RFM92W/95W

Libellium LoRa

Modtronix inAir4/9/9B

NiceRF LoRa1276

Most of SPI-based LoRa radio modules are supported. We recommend the Modtronix inAir model if you don't have delicate soldering experience as this module can come with header pins ready to be connected with Dupont wires.

The RFM95W can be found assembled (Adafruit) or an adapter can be purchased (from Ideatron for instance).

Connect the LoRa radio module

Connect the corresponding SPI pins of the radio module to the SPI pins on the Pro Mini board. MOSI (blue) is pin 11, MISO (green) is pin 12, CS (white) is pin 10 and CLK (orange) is pin 13 (right picture). Then connect also the VCC (red) and the GND (black) of the radio module to the VCC and the GND of the board (right picture). The VCC of the Pro Mini board gets 3.3v from the on-board voltage regulator.

COME AND DISCUSS WITH US

Internet of Things – From idea to reality, making it happen in Africa International Telecommunication Union Smart Incubator/WaziUp and WaziHub

Join us for a hands on practical workshop on how to design and deploy low-cost IoT across Africa. This workshop will focus on African user needs driven innovation in IoT, IoT training programmes and demos of real use cases of IoT deployment. This workshop is under the umbrella of the ITU Smart Incubator, a programme that supports technology oriented start-ups in the fields of AI, IoT and Blockchain. The workshop will be delivered in collaboration with the ITU Smart Incubator Knowledge Partners Waziup and Wazihub.

Line up:

1. Opening Remarks and Welcome Keynote
2. WaziUp IoT Initiative in Africa
3. IoT Capacity building and innovation ecosystem
4. Designing and deploying low-cost IoT in Africa (Senegal and Ghana pilots)
5. Case studies - IoT for fishing, cattle rustling and agriculture
6. Impact analysis



Session 254

📅 16:30–18:15, Thursday, 11 April 2019

📍 Room K2, ITU Montbrillant ⓘ

⚙️ Thematic Workshop