

DEPLOYING LOW-COST AND LONG-RANGE INTERNET OF THINGS IN DEVELOPING COUNTRIES

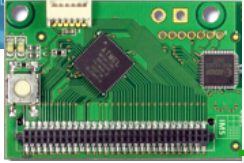
DISRUPTIVE
INTERNET
OF THINGS
APPLICATIONS
IN AFRICA

Logos at the bottom of the collage include: European Union, CTIC, Farmerline, iSpace, INNOVATIONS, coders africa, INNOTEO, and CREATE-NET.



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





LOW-COST HARDWARE



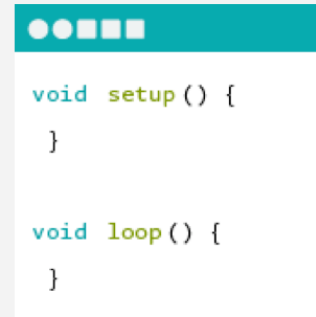
WHAT IS ARDUINO?

Arduino is an open-source electronics platform based on easy-to-use hardware and software. It's intended for anyone making interactive projects.



ARDUINO BOARD

Arduino senses the environment by receiving inputs from many sensors, and affects its surroundings by controlling lights, motors, and other actuators.

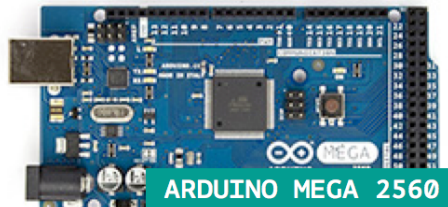


ARDUINO SOFTWARE

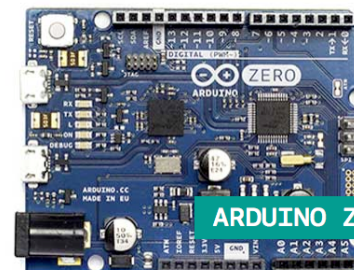
You can tell your Arduino what to do by writing code in the Arduino programming language and using the Arduino development environment.



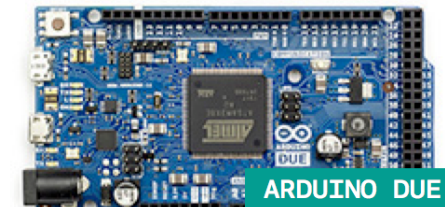
ARDUINO UNO



ARDUINO MEGA 2560



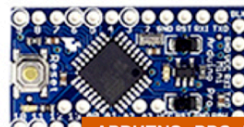
ARDUINO ZERO



ARDUINO DUE



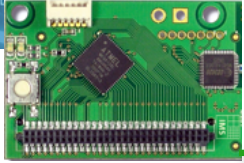
ARDUINO MICRO



ARDUINO PRO MINI

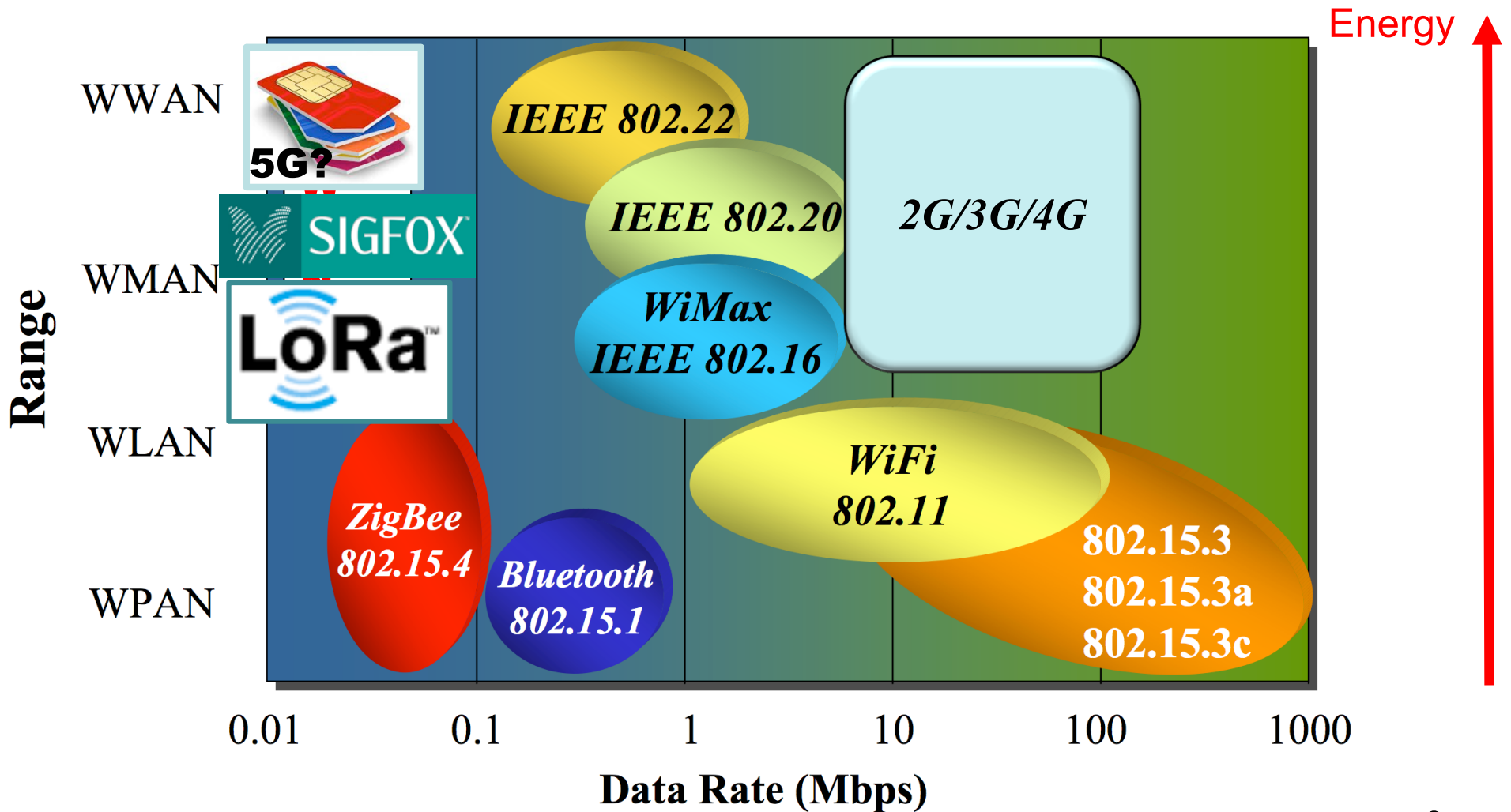


ARDUINO NANO

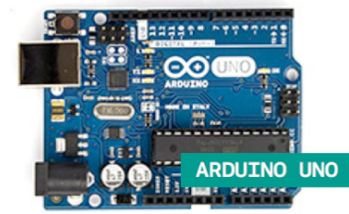


LOW-POWER AND LONG-RANGE?

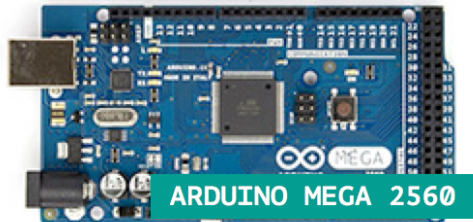
Energy-Range dilemma



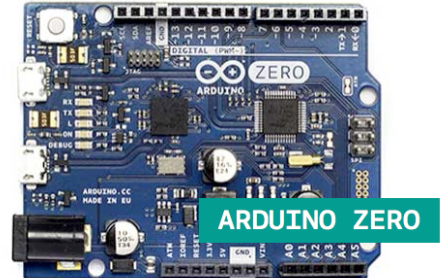
SW/HW BUILDING BLOCKS INTEGRATION



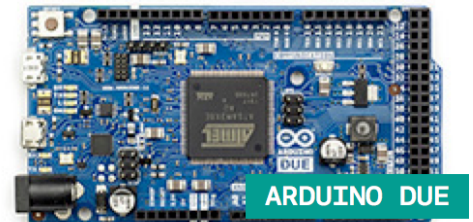
ARDUINO UNO



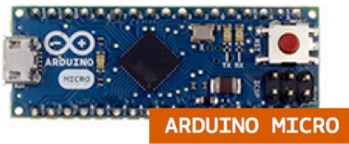
ARDUINO MEGA 2560



ARDUINO ZERO



ARDUINO DUE



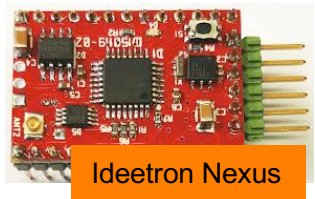
ARDUINO MICRO



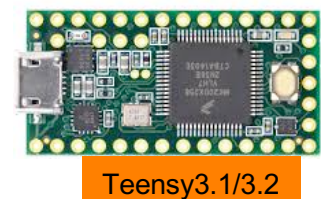
ARDUINO PRO MINI



ARDUINO NANO



Ideeatron Nexus



Teensy3.1/3.2

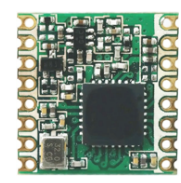


Adafruit Feather 32u4/M0

More to come...



LoRa radios that our library already supports



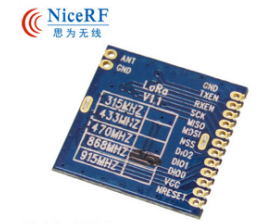
HopeRF RFM92W/95W



Libelium LoRa

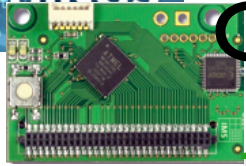


Modtronix inAir4/9/9B



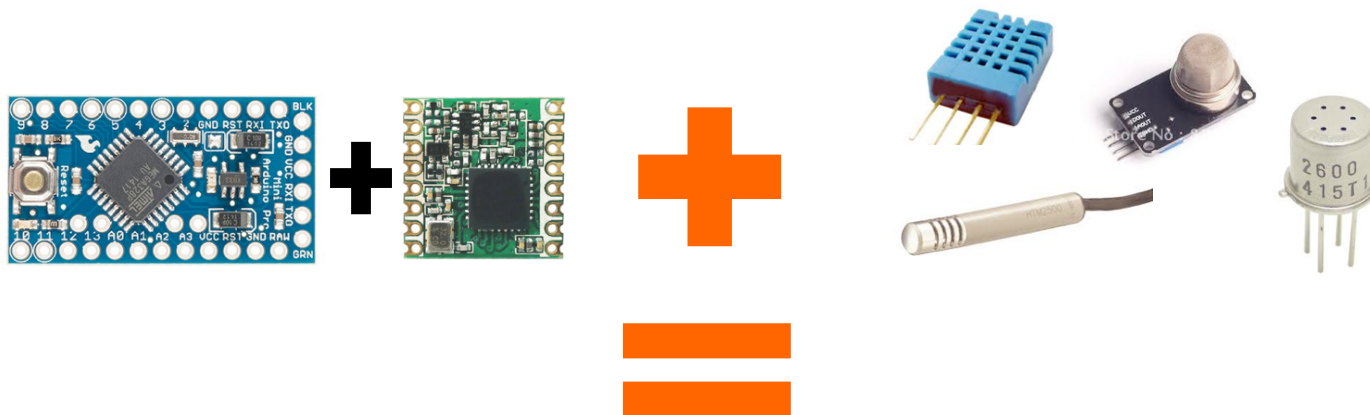
NiceRF LoRa1276

Long-Range communication library



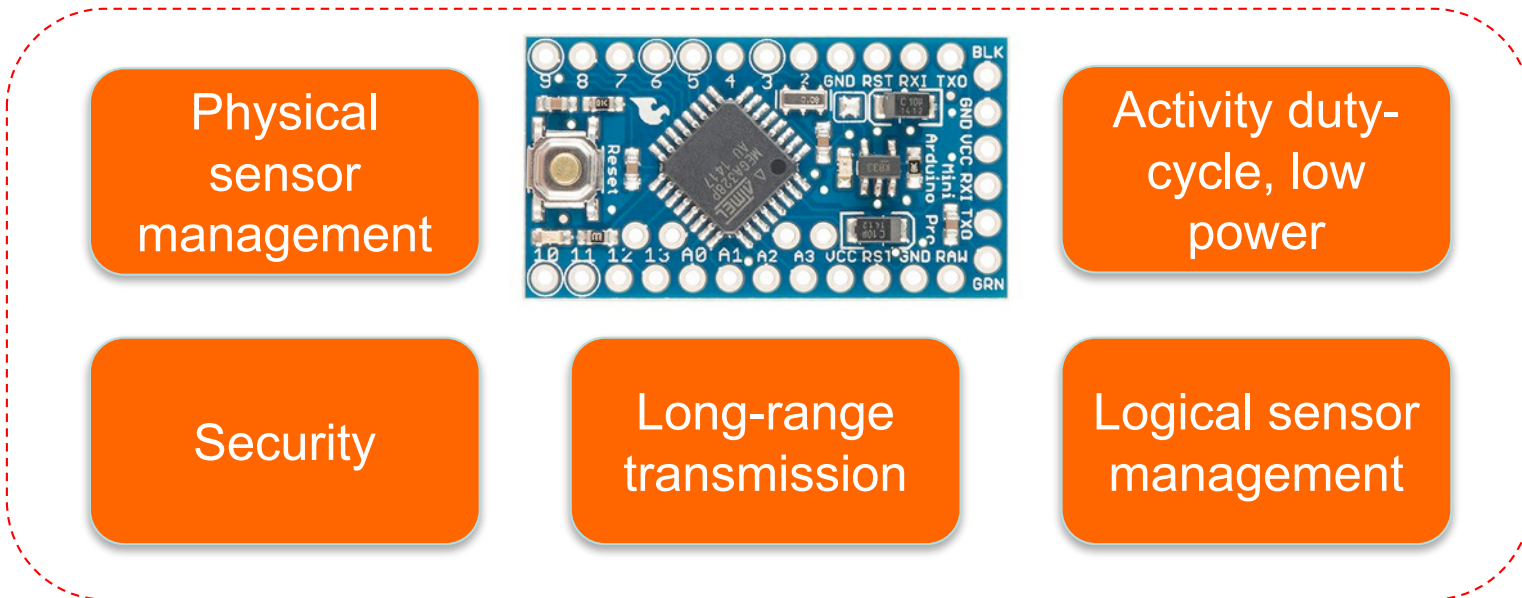
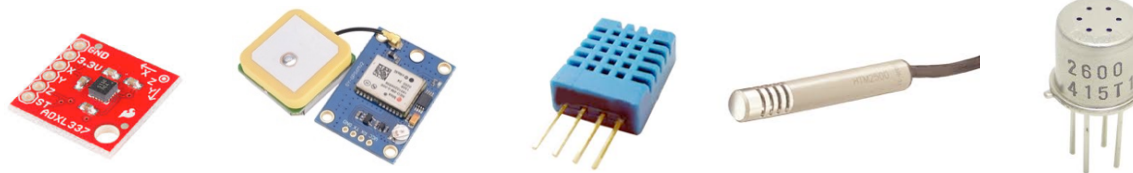
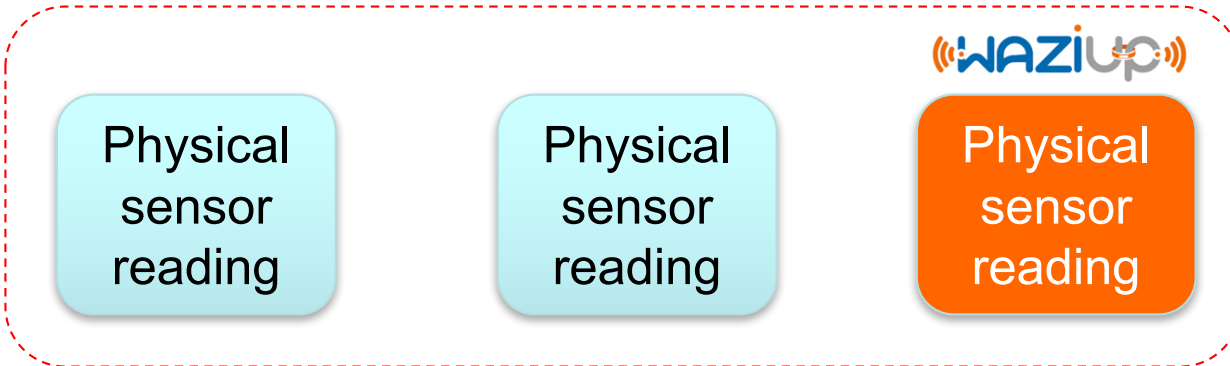
GENERIC SENSING IOT DEVICE

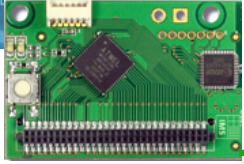
- ❑ Build low-cost, low-power, Long-range enabled generic platform
- ❑ Methodology for low-cost platform design
- ❑ Technology transfers to user communities, economic actors, stakeholders,...



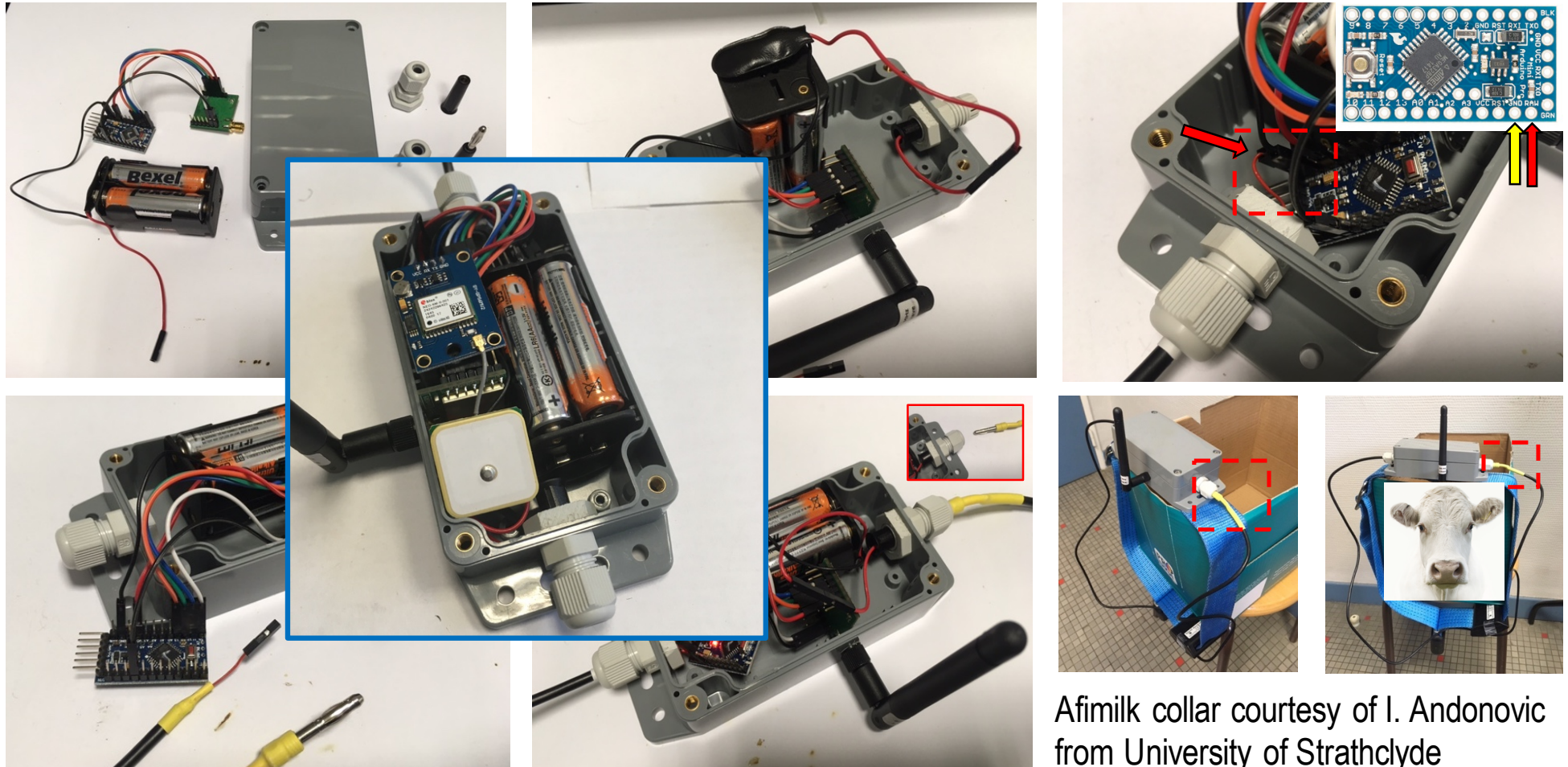


READY-TO-USE TEMPLATES

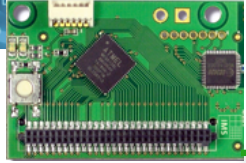




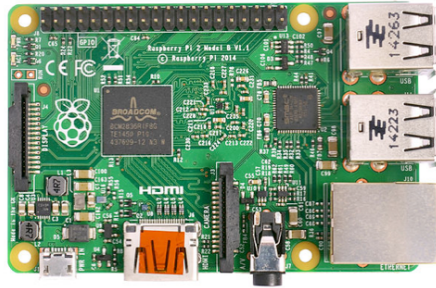
EASY INTEGRATION AND CUSTOMIZATION



Afimilk collar courtesy of I. Andonovic from University of Strathclyde



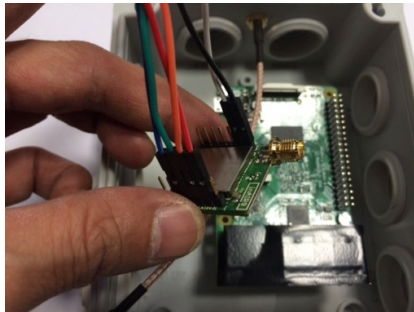
DIY & LOW-COST LORA GATEWAY

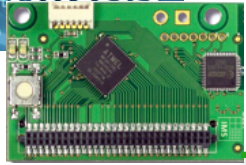


We can use all model of Raspberry. The most important usefull feature is the Ethernet interface for easy Internet connection. Then WiFi and Bluetooth can be added with USB dongles. RPI3 provides built-in Ethernet, WiFi and Bluetooth!

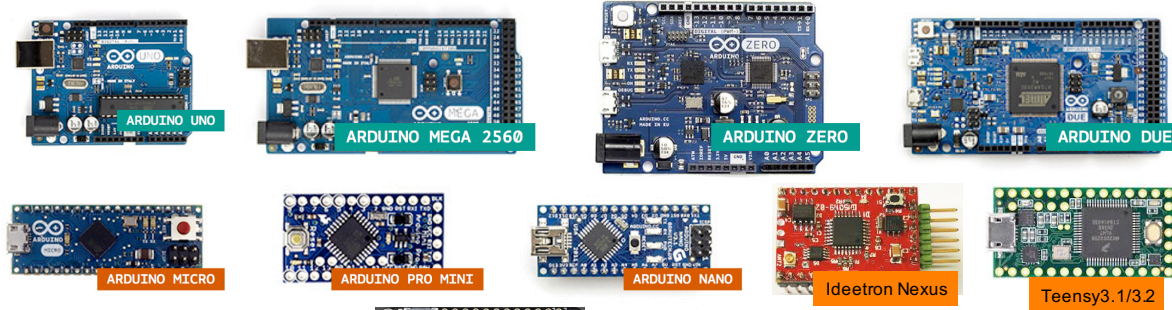


Less than 50€





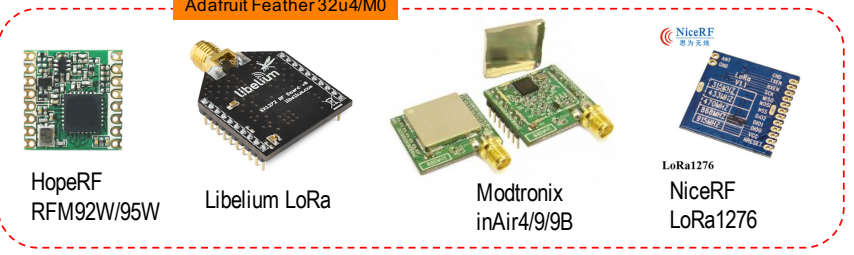
SIMPLICITY!



More to come...



LoRa radios that our library already supports

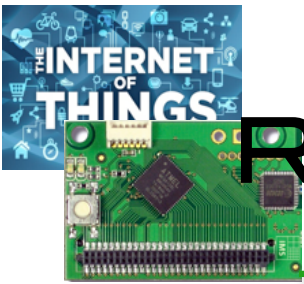


Long-Range communication library

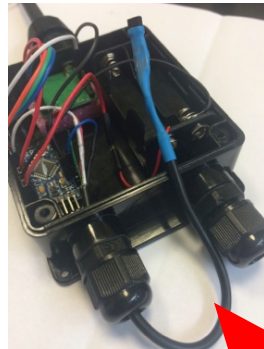
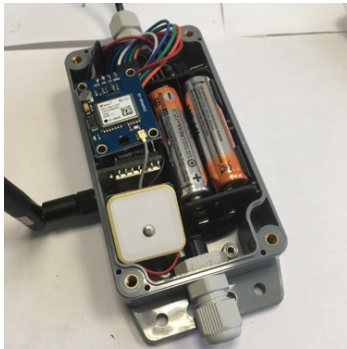


```
sendPacketTimeout("TC/18.5");
// sends to gateway
// TC : temperature celcius
// 18.5 : value
```

1 send function!



READY-TO-USE TEMPLATES

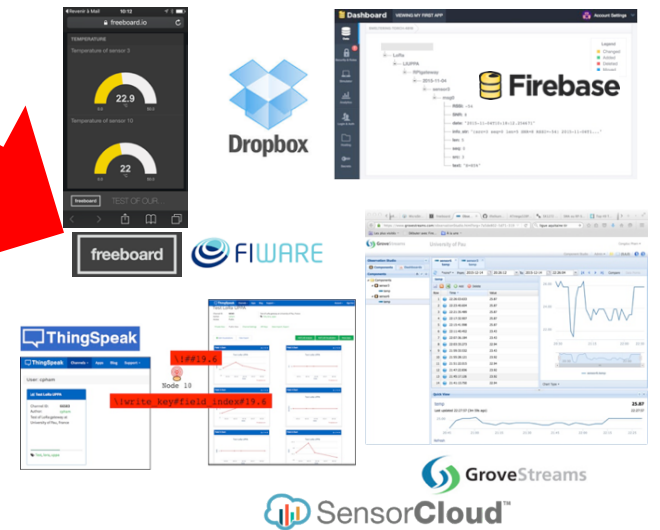


Step-by-step tutorial and source code available



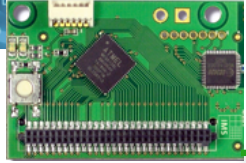
Step-by-step tutorial and source code available

Python scripts available



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

**NESTLÉ'S WATERSENSE
PROJECT USES WAZIUP
FRAMEWORK**



WATERSENSE



❑ Objectives

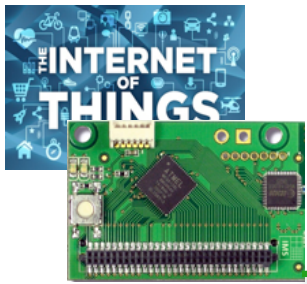
- ❑ Optimize water consumption for maize crop irrigation
- ❑ Measure soil moisture level at several depth
- ❑ Remote sensing + data analytics
- ❑ First step: deploy 3 pilot farms
- ❑ Second step: scaling up

❑ Local actors

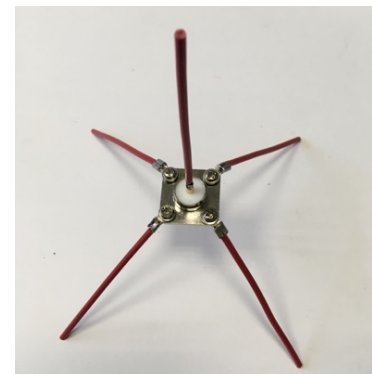
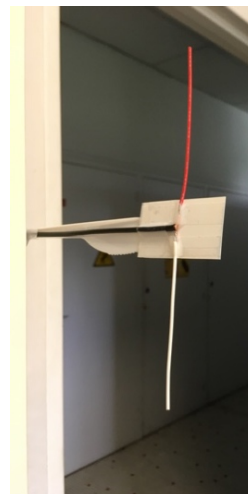
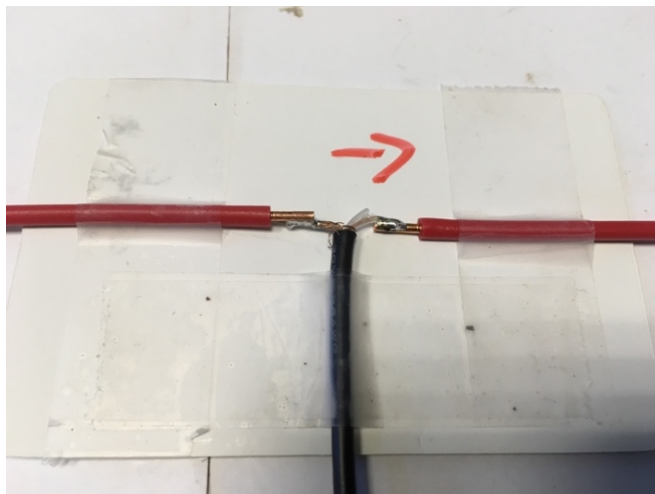
- ❑ Sarsabz farm team
- ❑ Lahore University of Management Sciences (LUMS)

❑ Contact persons

- ❑ Leonard Schrage (Nestlé Vevey & Globe)
 - Leonard.Schrage@nestle.com
- ❑ Mehbooh Elahi (Nestlé Pakistan Lahore)

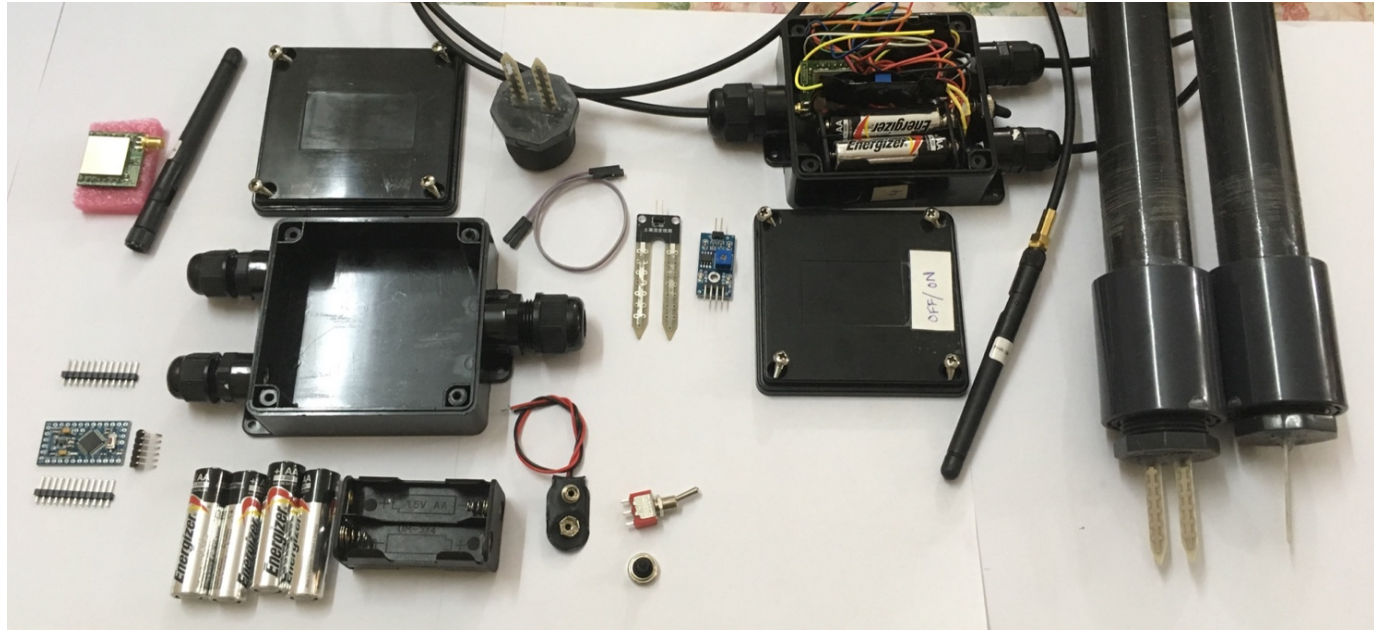


DIY APPROACH

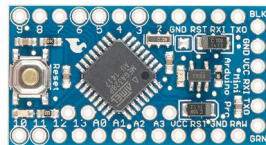




SENSING DEVICES



Physical sensor management



Activity duty-cycle, low power

Security

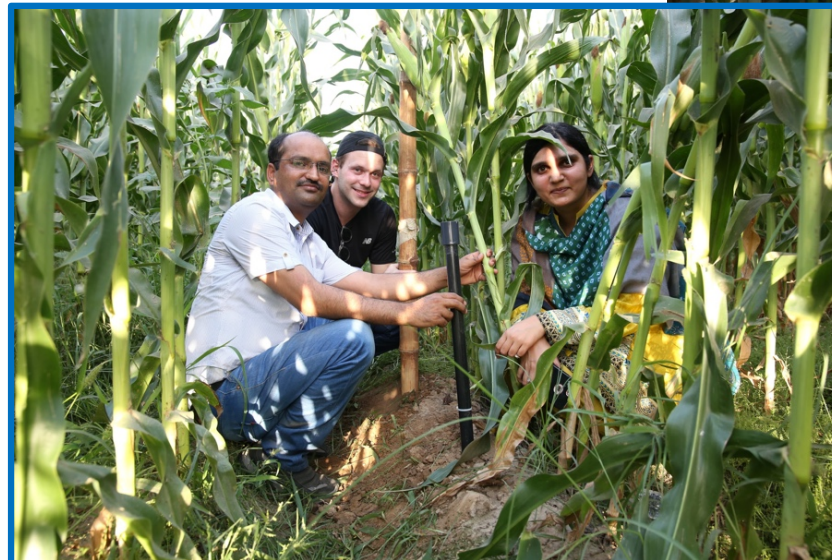
Long-range transmission

Logical sensor management





SENSING DEVICE DEPLOYMENT





TUTORIALS/RESOURCES



WAZIUP
EU H2020 grant agreement number 887617

Low-cost LoRa IoT devices and gateway FAQ

1) **What is Internet-of-Thing (IoT)?**
 From IERC (European Research Cluster on the Internet of Thing)
 The IERC definition states that IoT is "A dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network."
 From <http://www.gartner.com/it-glossary/internet-of-things/>
 "The Internet of Things (IoT) is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment."
 From <http://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT>
 "The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction."

2) **What is WAZIUP?**
 The EU H2020 WAZIUP project, namely the Open Innovation Platform for IoT-Big Data in Sub-Saharan Africa is a collaborative research project using cutting edge technology applying IoT and Big Data to improve the working conditions in the rural ecosystem of Sub-Saharan Africa. First, WAZIUP operates by involving farmers and breeders in order to define the platform specifications in focused validation cases. Second, while tackling challenges which are specific to the rural ecosystem, it also engages the flourishing ICT ecosystem in those countries by fostering new tools and good practices, entrepreneurship and start-ups. Aimed at boosting the ICT sector, WAZIUP proposes solutions aiming at long term sustainability.
 WAZIUP will deliver a communication and big data application platform and generate locally the know how by training by use case and examples. The use of standards will help to create an interoperable platform, fully open source, oriented to radically new paradigms for innovative applications/services delivery. WAZIUP is driven by the following visions:
 1. Empower the African Rural Economy. Develop new technological enablers to empower the African rural economy now threatened by the concurrent action of rapid urbanization and of climate change. WAZIUP technologies can support the necessary services and infrastructures to launch agriculture and breeding on a new scale.

Author : Congduc Pham, University of Pau, France
 page 1
 Last update : 07.09.2016

TUTORIAL ON HARDWARE & SOFTWARE FOR LOW-COST LONG-RANGE IOT

WAZIUP

LIUPPA T21 team

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

UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

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

WAZIUP

LIUPPA T21 team

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

UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

BUILDING AN IOT DEVICE FOR OUTDOOR USAGE: A STEP-BY-STEP TUTORIAL

WAZIUP

LIUPPA T21 team

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

UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

LOW-COST LORA IOT DEVICE: SUPPORTED PHYSICAL SENSORS

WAZIUP

LIUPPA T21 team

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

UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

LOW-COST LORA GATEWAY: A STEP-BY-STEP TUTORIAL

WAZIUP

LIUPPA T21 team

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

UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

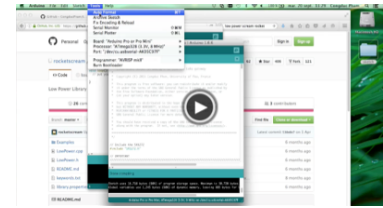
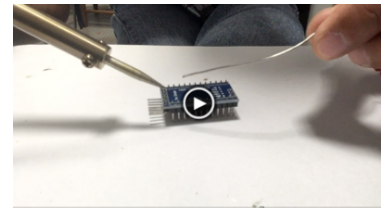
LOW-COST LORA IOT: USING THE WAZIUP DEMO KIT

WAZIUP

LIUPPA T21 team

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

UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR





Thanks.
Let's keep in touch



Carine VAVASSEUR

Communication & Event Manager

Carine.vavasseur@cticdakar.com

www.cticdakar.com
contact@cticdakar.com



facebook.com/waziupIoT



twitter.com/waziupIoT



linkedin.com/groups/8156933



github.com/waziup