

INNOVATING IN AFRICA WITH INTERNET-OF-THINGS TECHNOLOGIES: TOWARDS A SMARTER WORLD!



DISRUPTIVE
INTERNET
OF THINGS
APPLICATIONS
IN AFRICA

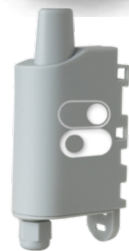
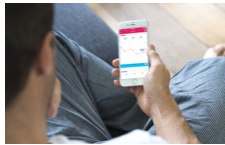
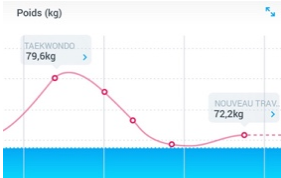
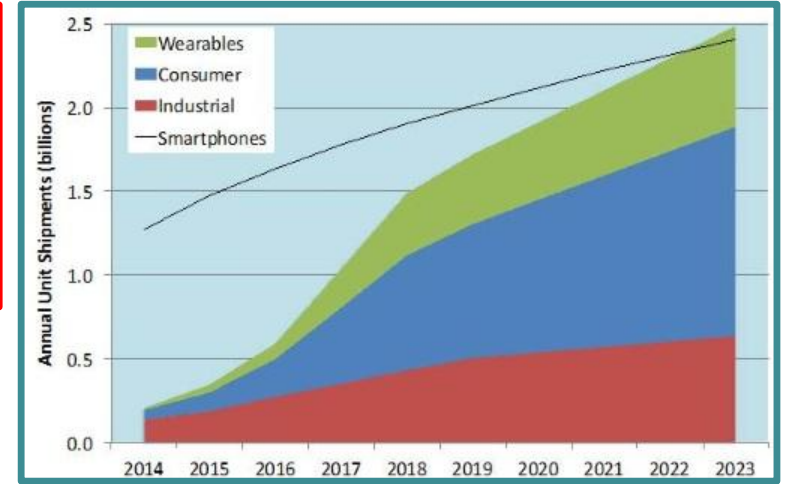


AAIS webinar – Presented on Dec 16th, 2020

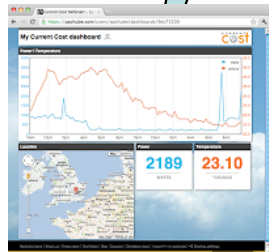
Prof. Congduc Pham
<http://www.univ-pau.fr/~cpham>
Université de Pau, France



Internet-of-Things



Sense, Monitor, Optimize & Control



**DATA ANALYSIS,
OPTIMIZATION & CONTROL**

MONITORING

**SENSING
PHYSICAL WORLD INTERACTION**

APPLICATION DOMAINS



IoT for development!



Irrigation



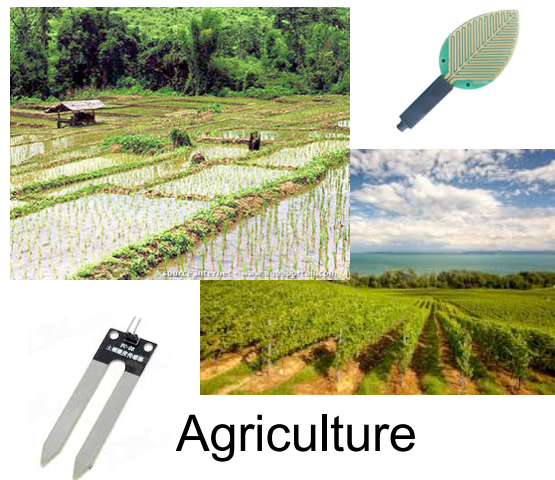
Livestock farming



Fish farming & aquaculture



Logistic, Storage,
Asset Tracking



Agriculture

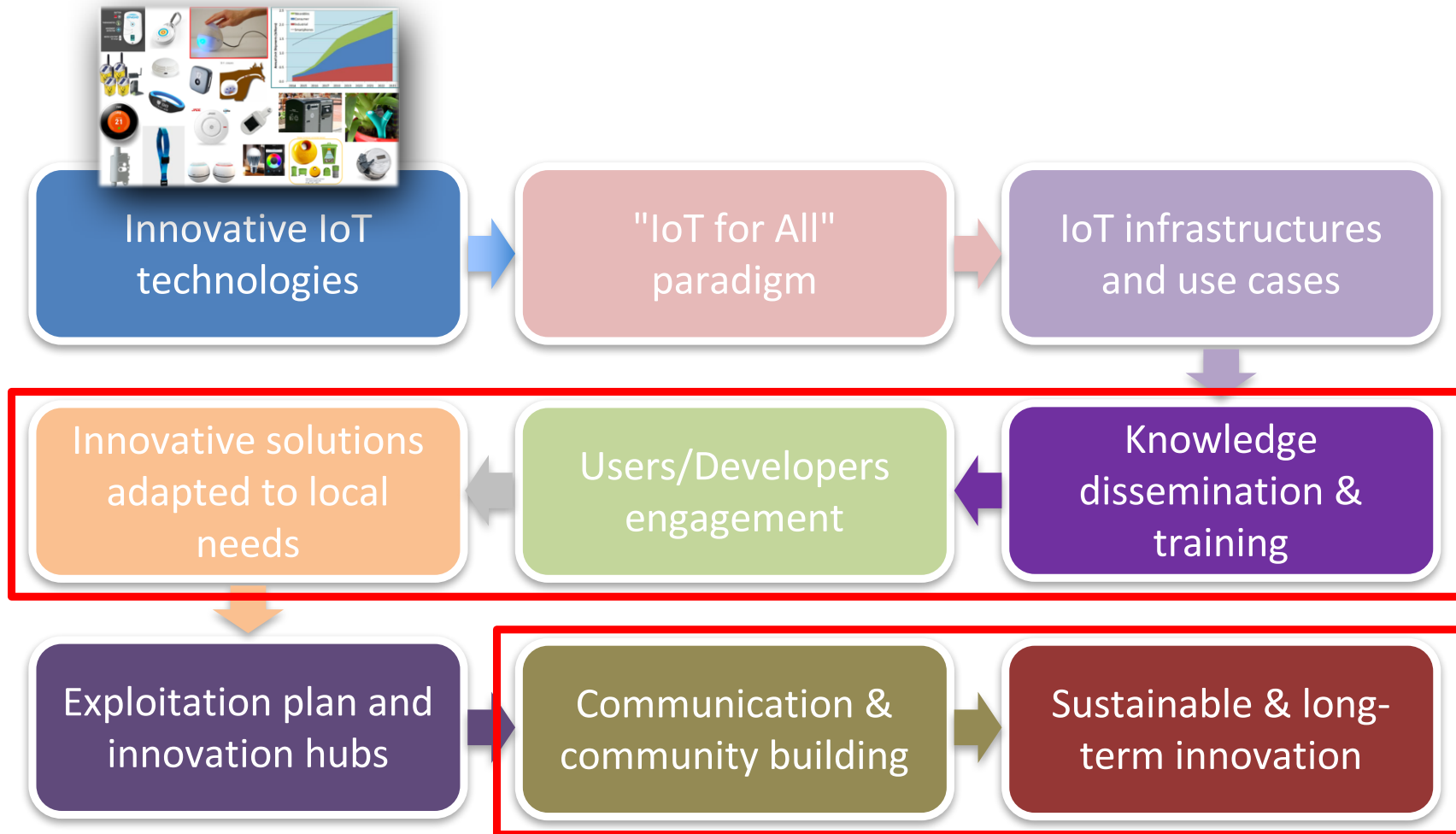


Fresh water

Example: Smart Agriculture



Making real IoT happening!





WAZIUP Open IoT and Big data platform for Africans, by Africans

FEB2016-JAN2019



Affordable technologies to empower rural economics



Exploit advanced research capitalizing on IoT and Big data state-of-the art findings



Develop IoT solutions and applications meeting African needs



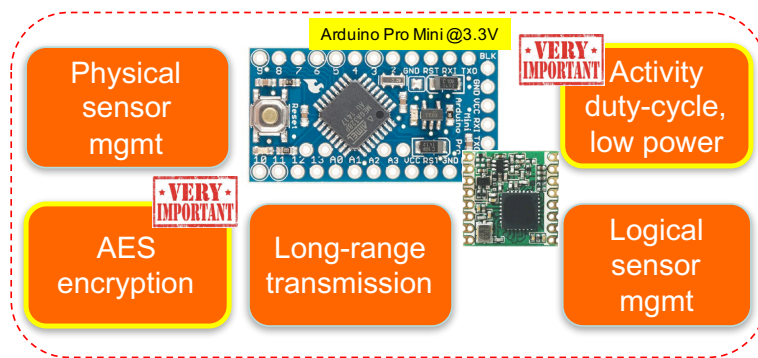
- www.waziup.eu
- Waziup IoT
- Waziup IoT
- Waziup
- Waziup



waziup.community@create-net.org

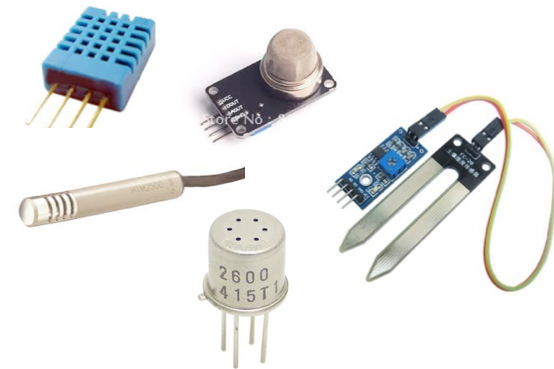
Generic IoT v.s. highly specialized

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

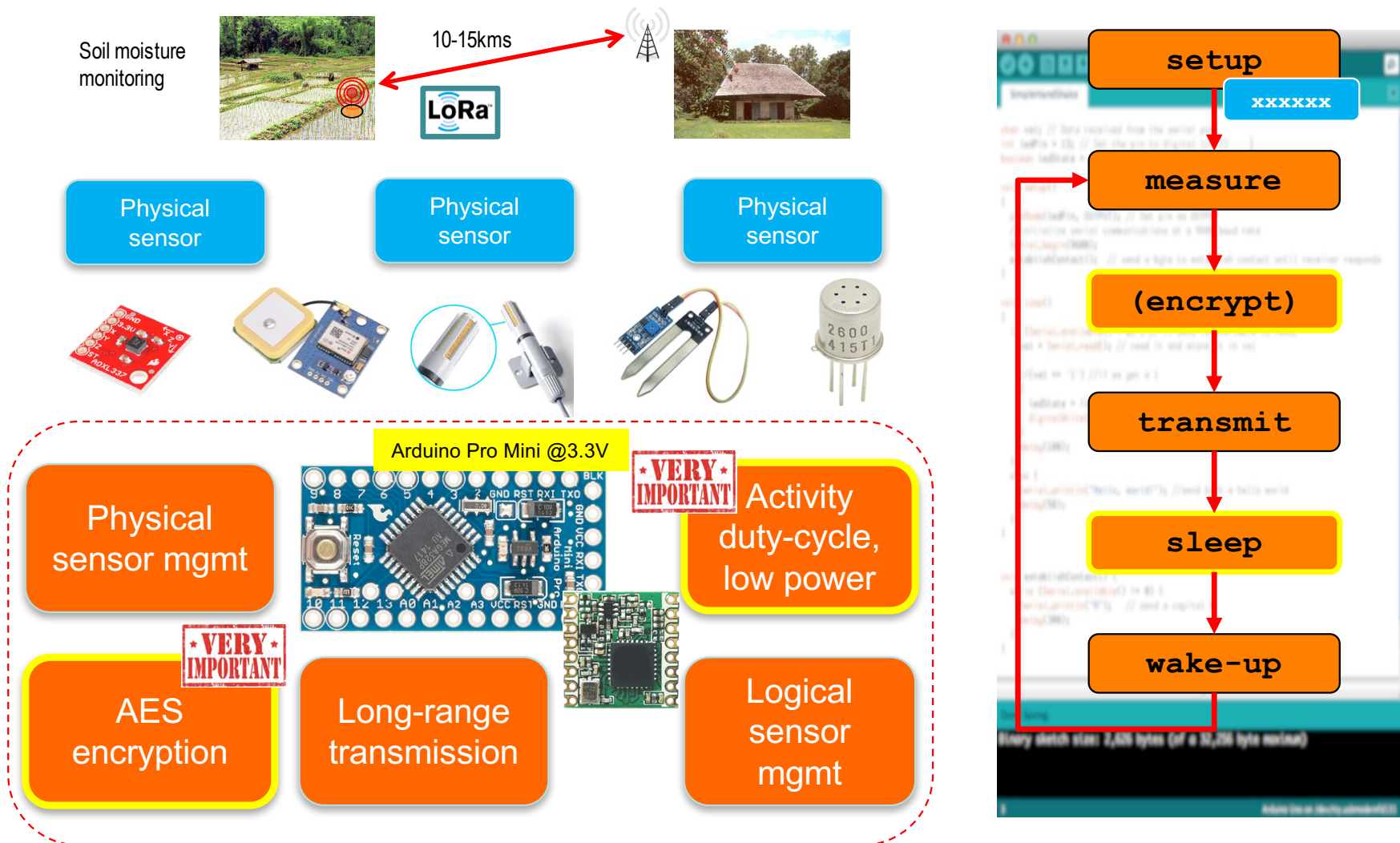


+

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Simple development cycle



Building domain-specific sensors



Photo from EGM

Photo from Unparallel

Bin presented at Woelab



Open, versatile IoT gateway



Soil moisture monitoring



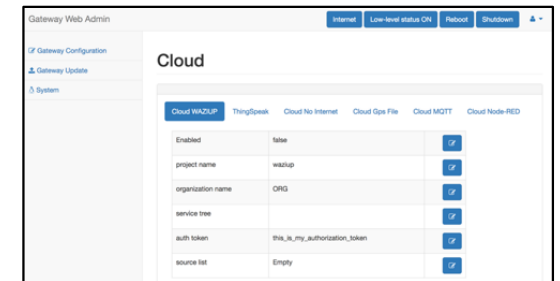
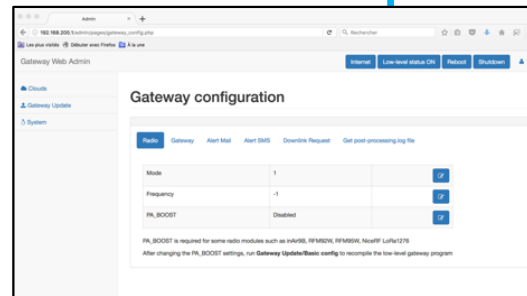
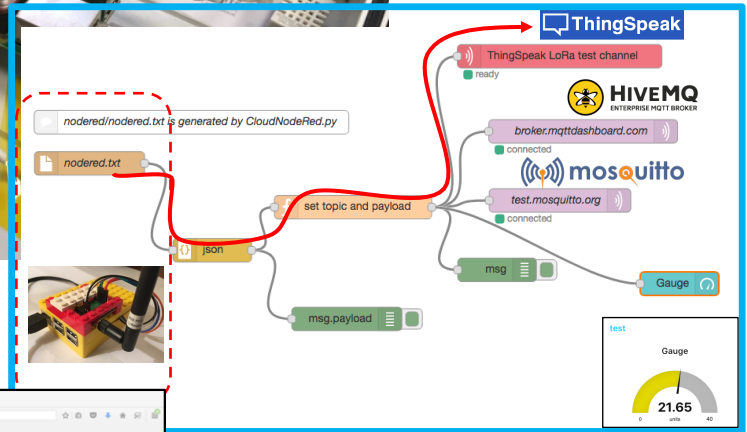
10-15kms



Latest distribution

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

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



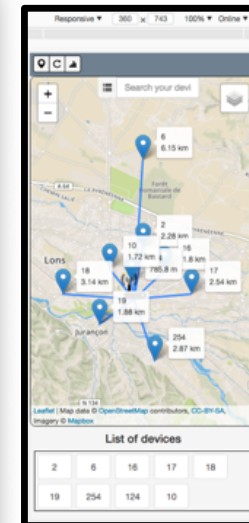
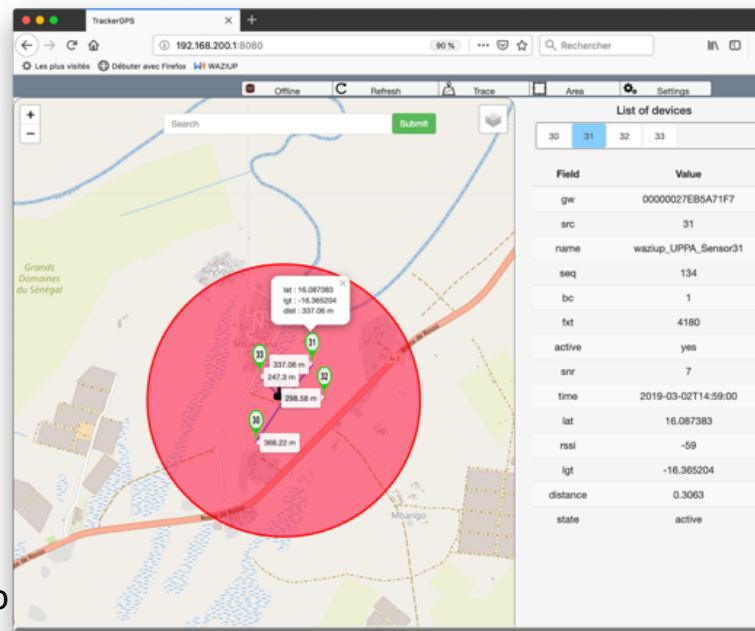
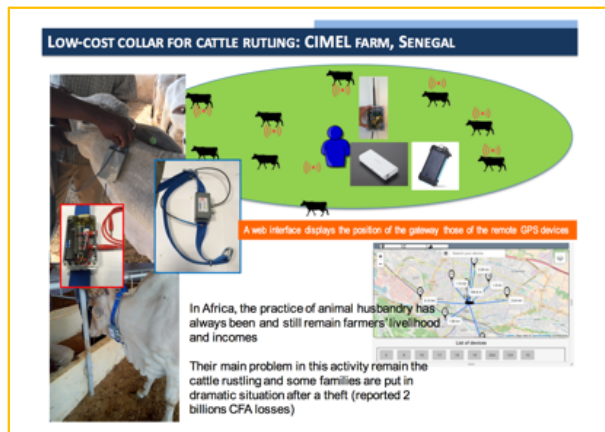
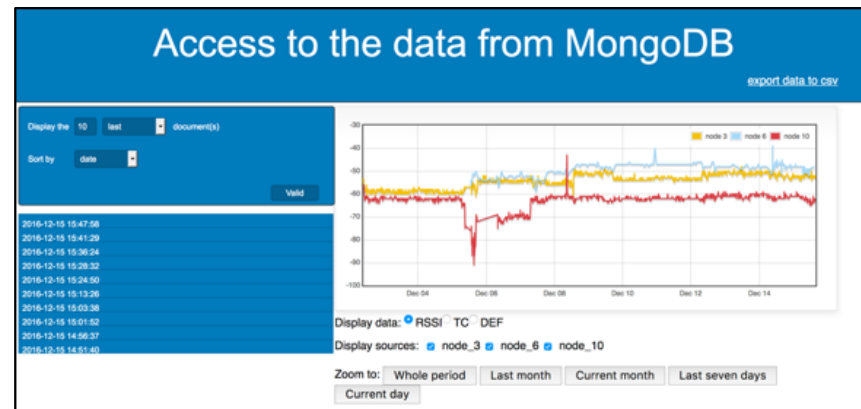
Deployment in rural areas no Internet ☹️

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



WAZIUP: deploying IoT in Africa

Autonomous gateway – no Internet scenario



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

Tutorials/resources

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

WAZIUP
EU Horizon 2020 grant agreement number 101017427

Low-cost LoRa IoT devices and gateway FAQ

1) **What is Internet-of-Thing (IoT)?**

From IERC (European Research Cluster on the Internet of Things)

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 and good practices, entrepreneur sector. WAZIUP proposes solutions that:

WAZIUP will deliver a connected gateway locally the know how breeders will need to create and to radically new paradigms for breeders by the following objectives:

1. Empower the African R&D to empower the African R&D of local innovation and support the necessary funding on a new scale

Author : Congduc Pham, University of Pau
Last update : 07/09/2018

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

WAZIUP

LIUPPA

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

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

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

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LOW-COST LORA IOT DEVICE: SUPPORTED PHYSICAL SENSORS

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

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LOW-COST LORA IOT: USING THE WAZIUP DEMO KIT

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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 5MHz** 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, mostly from Chinese manufacturers. The last solution is very cost-effective as the Pro Mini board can be purchased for a bit more than 4€ a piece.

Depending to connect pins may pin with a soldered

The LoRa radio module

There are various LoRa radio modules that are all based on the Semtech SX1272/127x.

LoRa

Fully tested LoRa radio modules

Hopif RFM92W
Lilium LoRa
Mudrama HA439B

Most of off-based LoRa radio modules are supported. We recommend the Mudrama (HA439B) if you don't have delicate soldering experience as this module can come with header pins ready to be connected with DuPont wires.

The RFM92W can be found assembled (Astarind) or an adapter can be purchased from (Sensen) for instance.

Connect the LoRa radio module

Connect the connector module to the SPI pins (blue) in pin 21, MISO pin 30 and CS pin (orange) Then connect also the of the radio module to board (right side). The VCC of the Pro Mini board gets 3.3v from the on-board voltage regulator.

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LOW-COST LORA GATEWAY: WEB ADMIN INTERFACE

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LOW-COST LORA IOT ANTENNA TUTORIAL FOR GATEWAY

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IOT DEPLOYMENT WITH WAZIUP ***

GUIDELINES, BEST PRACTICES, TROUBLESHOOTING AND FAQ

WAZIUP

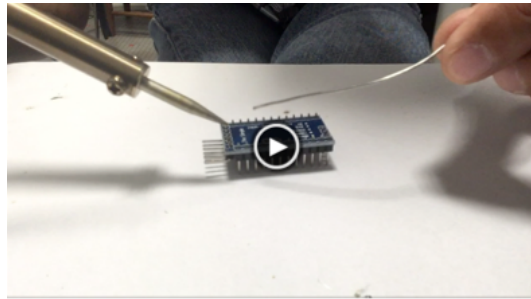
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YouTube videos

Low-cost LoRa IoT device



+92000 views

Dec2020

https://www.youtube.com/watch?v=YsKbJeeav_M

Low-cost LoRa IoT gateway



+21000 views

Dec2020

<https://www.youtube.com/watch?v=mj8ltKA14PY>

Extreme low-power LoRa IoT



+8900 views

Dec2020

https://www.youtube.com/watch?v=2_VQpcCwdd8

Setting up a gateway in 5mins



+4300 views

Dec2020

<https://www.youtube.com/watch?v=CJbUFXLpSok>

Community building for sustainable innovation

International Events
+ 20 organized & attended

Workshop at the European Conference on Networks & Communications (Greece, CNET)



Launch event (Ghana, iSpace)



IoTWeek2016 (Belgrade, EGM)



Launch event (Senegal, CTIC Dakar)



IoTBigData2016 (Italy, EGM)



IoT Care Conference (Budapest, CNET)

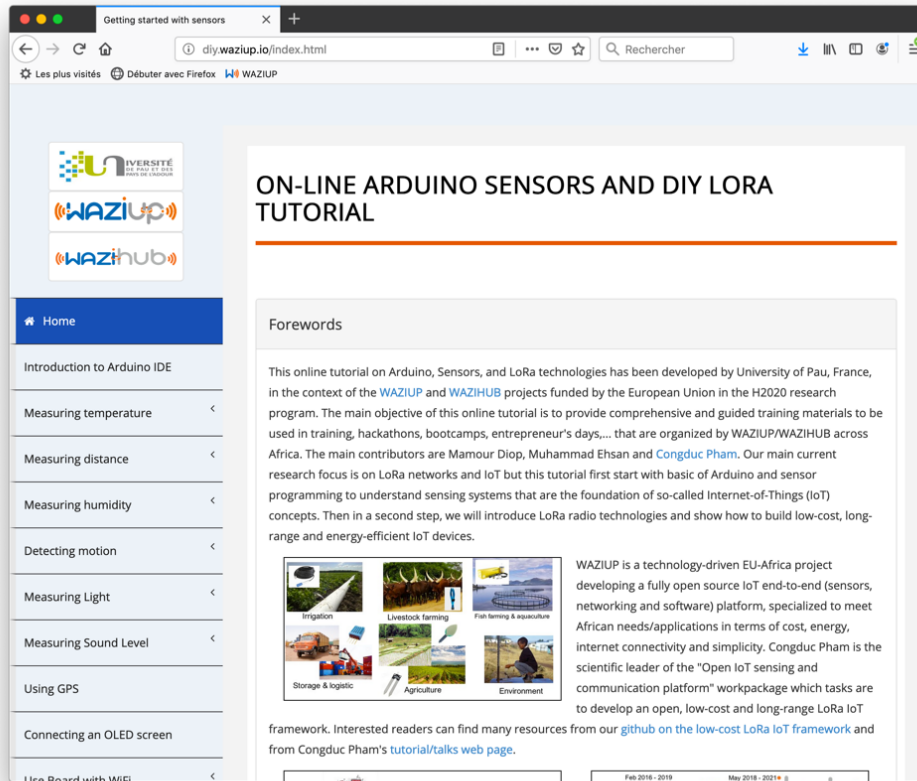
WAZIUP Workshop on IoT (Togo, L'Africaine d'Architecture)



Workshop at the RESSACS 2016 (France, UPPA)

Training & hackathons

- Technical training sessions
- Hackathons, ...



Online Arduino & IoT step-by-step tutorial
<https://diy.waziup.io>

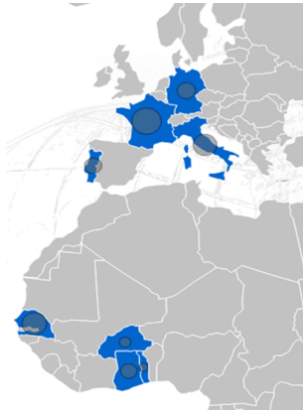




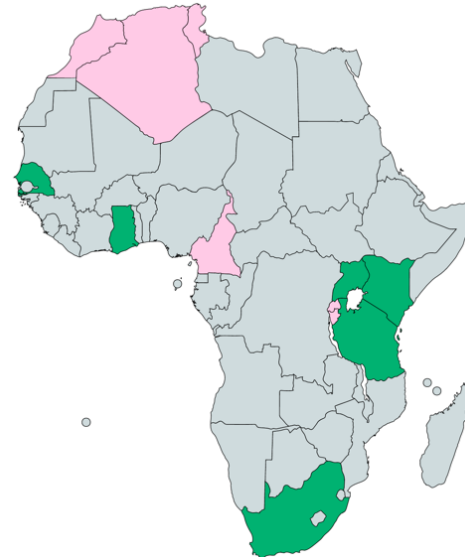
Scaling up!



Feb 2016 - 2019



May 2018 - 2021





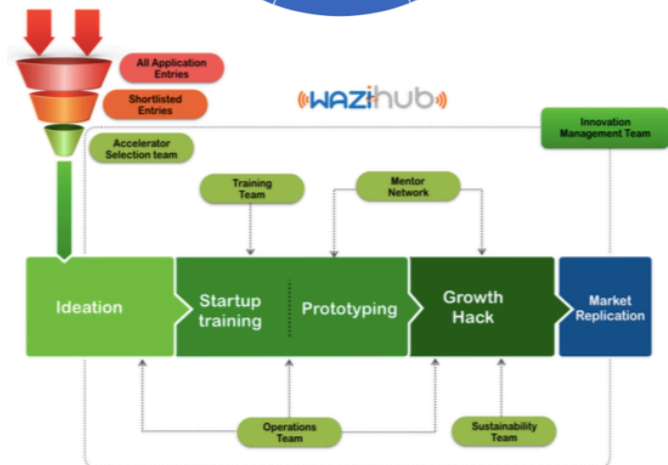
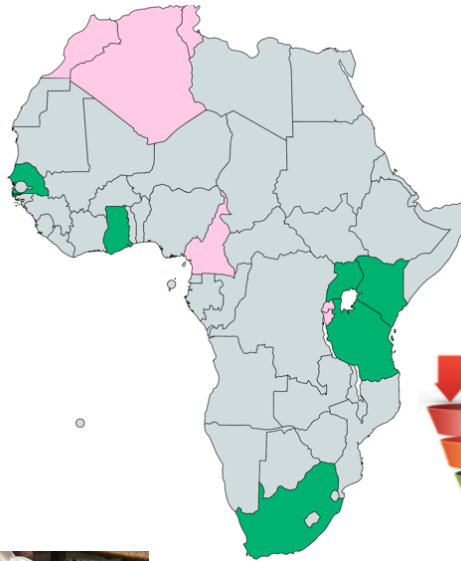
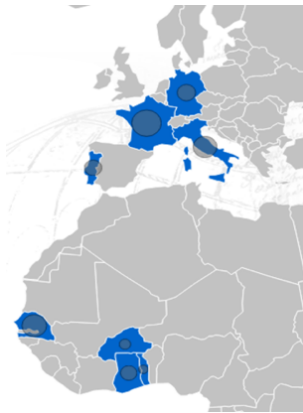
WAZIUP & WAZIHUB articulation



Feb 2016 - 2019



May 2018 - 2021



🔗 <http://diy.waziup.io>

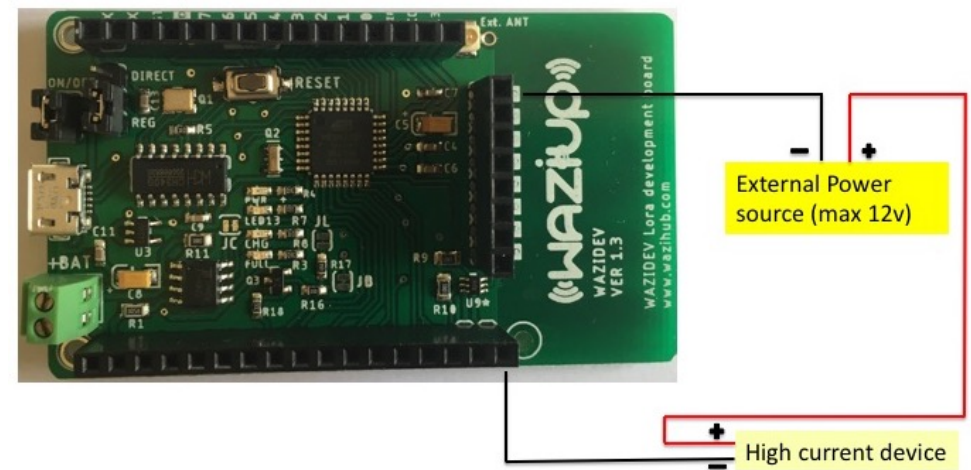
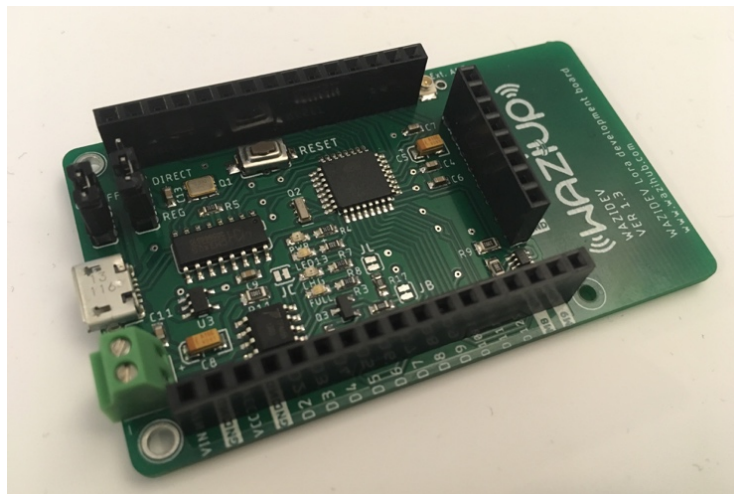
WAZIUP IoT Courses

For users who wants to gain knowledge on IoT in a step-by-step lecture mode, we have defined the following courses:

- Fundamentals of IoT**
 - F-IOT-1a: What is IoT
 - Quick Introduction to IoT - WAZIUP
 - IoT and Big Data Platform - WAZIUP
 - Intel IoT -- What Does The Internet of Things Mean? - YouTube
 - Eureka -- Internet of Things (IoT) | What is IoT | How it Works? - YouTube
 - Geospatial IoT -- IoT- What is Internet of Things? - YouTube
 - IBM Think Academy -- How It Works: Internet of Things? - YouTube
 - F-IOT-1b: Introduction to Basic Electronics
 - Introduction To Basic Electronics - WAZIUP
 - Introduction To Basic Electronics - Instructables
 - Basic Electronics - Instructables
 - Introducing physical sensors, part 1 - WAZIUP
 - Introducing physical sensors, part 2 - WAZIUP
 - F-IOT-2a: Understanding IoT Devices - WAZIUP
 - F-IOT-2b: Introduction to IoT hardware - WAZIUP
 - F-IOT-3: Introduction to Arduino IDE - WAZIUP
 - Introduction to Arduino IDE - YouTube
 - Presentation of the Arduino IDE - WAZIUP
 - Setting up the Arduino IDE - WAZIUP
 - F-IOT-4: WAZIUP Open Technologies for Low-cost IoT - WAZIUP
- Prototyping and Testing: Getting started**
 - D-IOT-1: Getting started with WaziDev
 - Overview of WaziDev and NanoIoT
 - The WaziDev board in more details - WAZIUP
 - Resources on github repository - WAZIUP
 - Installing WAZIUP software and WaziDev - WAZIUP
 - Installing WaziDev and NanoIoT - WAZIUP
 - Prototyping and Testing: Getting started**
 - D-GW-1: Building & Configuring a WaziGateway
 - Quick overview of WAZIUP gateway - WAZIUP
 - Installing gateway software on WaziGateway - WAZIUP
 - Connecting to Gateway and Backend - WAZIUP
 - Configuring Gateway and Settings - WAZIUP
 - D-GW-2: Building an Outdoor Gateway - WAZIUP
 - D-GW-3: Antenna Tutorial for Gateway - WAZIUP
 - D-GW-4: Gateway Web Admin Interface - WAZIUP
 - D-GW-5: Migrating & Using WaziGateway - WAZIUP
- Prototyping and Testing: Deployment Guidelines**
 - D-IOT-2: WAZIUP IoT and Gateway Deployment Guidelines - WAZIUP
- Prototyping and Testing: Introduction to WAZIUP IoT cloud Platform**
 - D-CLOUD-1: Introduction to WAZIUP cloud dashboard - WAZIUP
 - D-CLOUD-2: Create your app with WAZIUP - WAZIUP
- Advanced understanding**
 - A-IOT-1: LoRa & LoRaWAN explained - WAZIUP
 - A-IOT-2: LoRaWAN with WAZIUP - WAZIUP
 - A-CLOUD-1: WAZIUP cloud API reference - WAZIUP

WAZIDev board

- ◉ Fully integrated development board: WAZIDev
 - ◉ Integrated MCU (ATMega328P, 3.3V & 8MHz)
 - ◉ On-board FTDI chip
- ◉ Features
 - ◉ All pins of MCU will be exposed
 - ◉ 2 MOSFET transistors to control energy-consuming sensors (e.g. GPS)



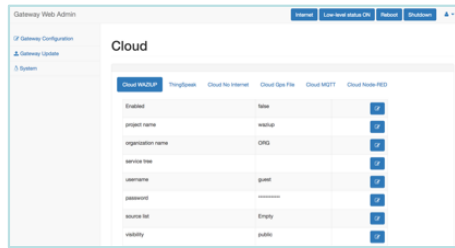
e.g. WAZIGate

- ⦿ Based on the general distribution
- ⦿ Enhanced with more specific web UI
- ⦿ Enhanced with Docker environment
- ⦿ Provides ready-to-use WAZIUP gateway distribution



"Branding" your IoT gateway

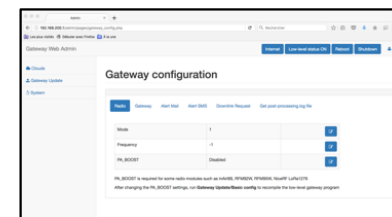
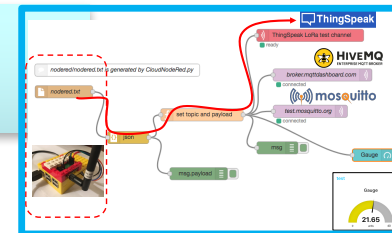
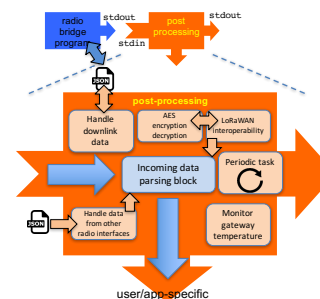
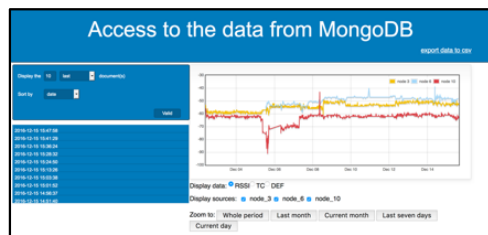
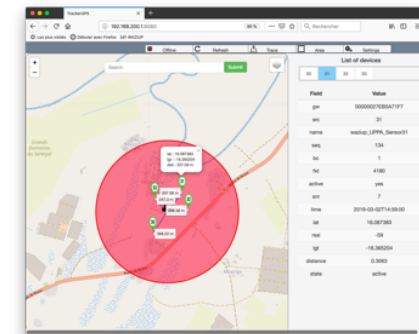
- Develop/Add project/company specific features on top of the general distribution



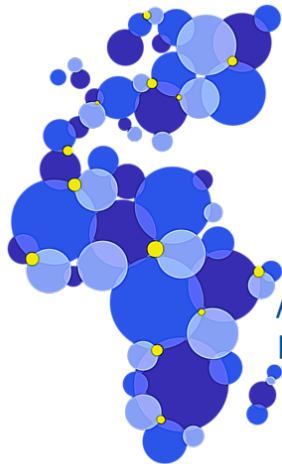
ADDITIONAL FEATURES SET 2

ADDITIONAL FEATURES SET 1

GENERAL DISTRIBUTION



Emergence of an ecosystem!

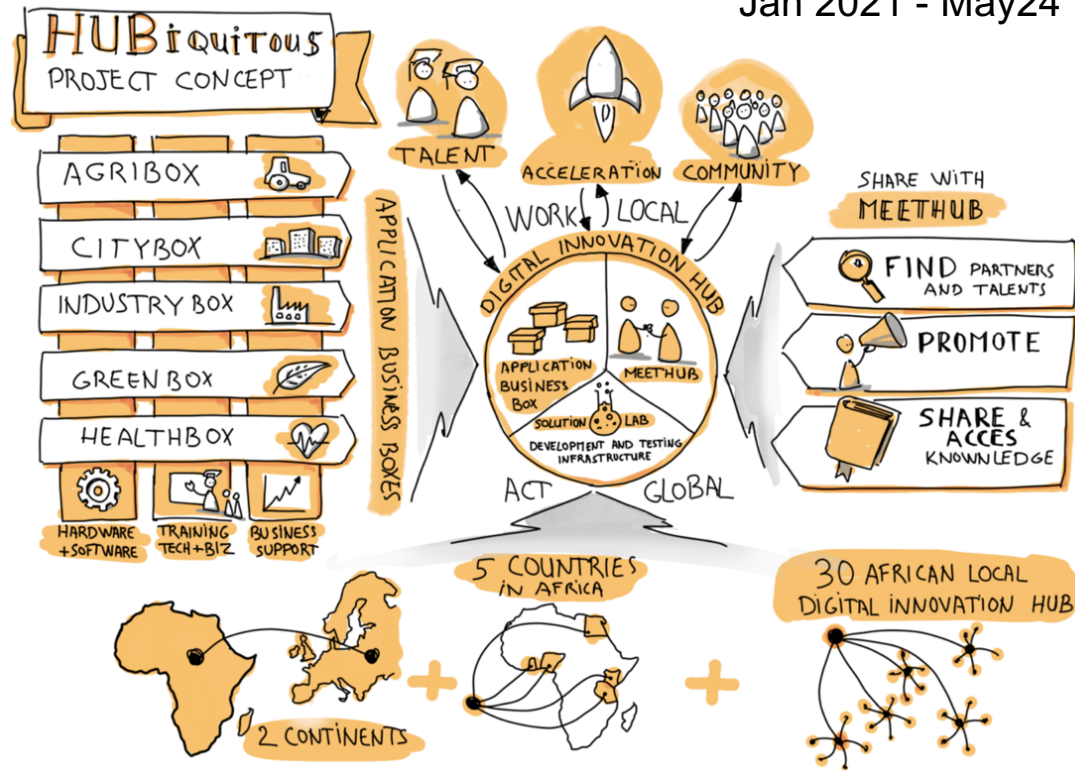


Beyonds state-of-the-art!

HUBiBiquitous

Widen the scope of technologies to prepare for the next 10 years of innovation in IoT, AI & BigData

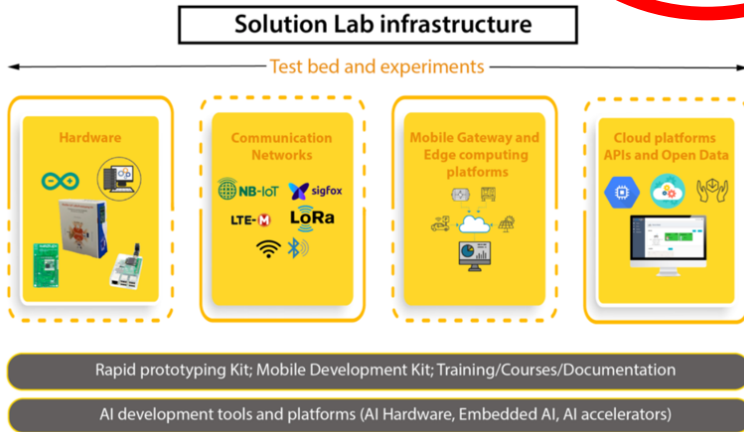
Jan 2021 - May24



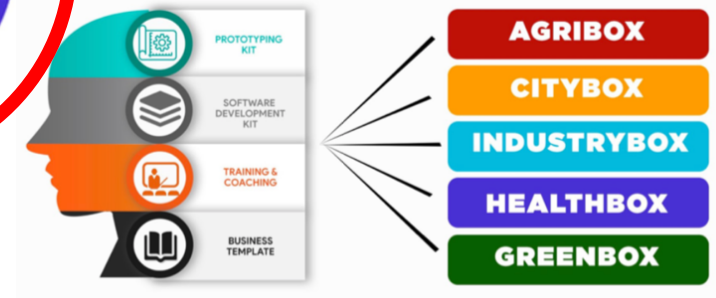
3 Innovation Enablers



Create vertical solutions with go-to-market objectives



Create synergies amongs innovation actors, DIHs, stakeholders,...



Search Partners
Search DIHs, Start-up, Incubators for partnership

Search Talent
Search African Talents for collaboration

Promote Innovation
For DIH, Startup to promote services to ecosystem

Access HUBbiquitous Digital Resources
Access digital resources related to innovation enablers, programs, course and training materials

Make disruptive technologies accessible to entrepreneurs!

INNOVATING IN AFRICA WITH INTERNET-OF-THINGS TECHNOLOGIES: TOWARDS A SMART AFRICA



INNOVATIVE
INTERNET
OF THINGS
APPLICATIONS
IN AFRICA



AAIS webinar – Presented on Dec 16th 2015

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

