

# THE IOT LORA PROJECT

## PRESENTATION

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# PRODUCT MARKETING SHEET: SMART SENSOR

The Smart Sensor send sensors data to his gateway by radio

## Sensors :

- Temperature
- Humidity
- Brightness
- Localisation, Hour, Date

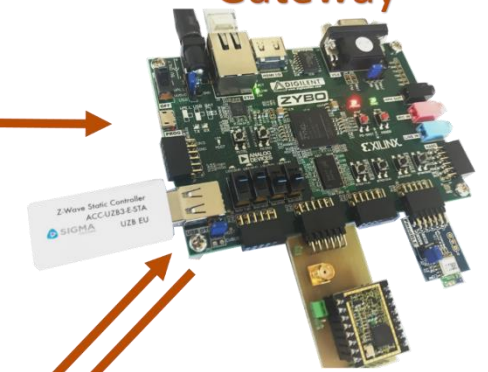
## Radio modules:

- LoRa (long range  $\approx 1$  Km)
- Bluetooth Low Energy BLE ( $\approx 10$  m)

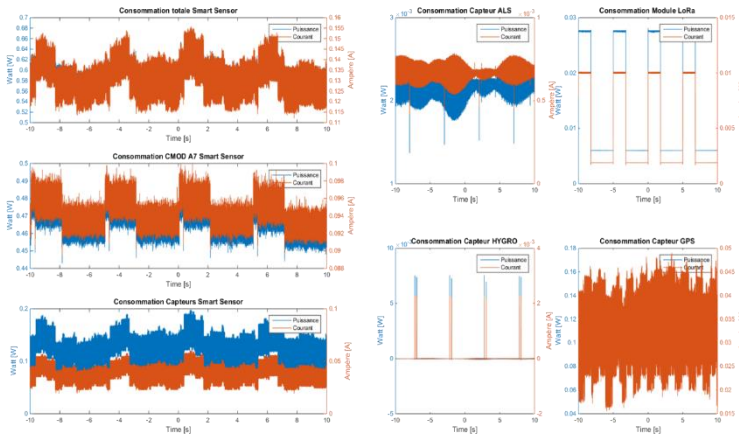
Smart Sensor



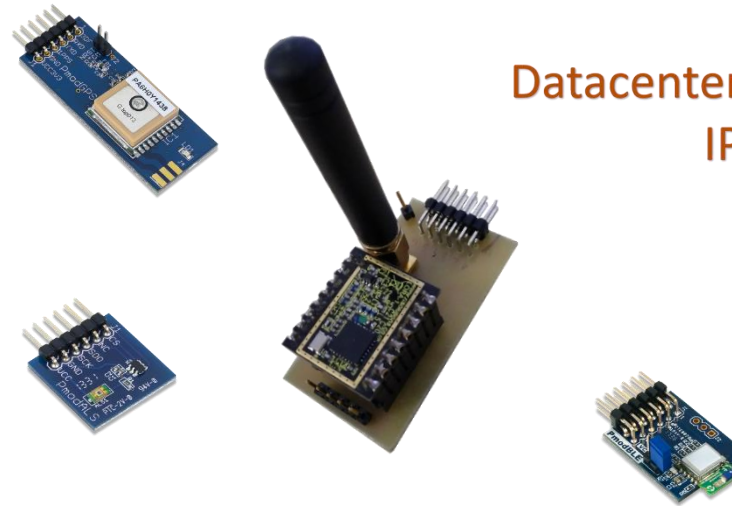
Gateway



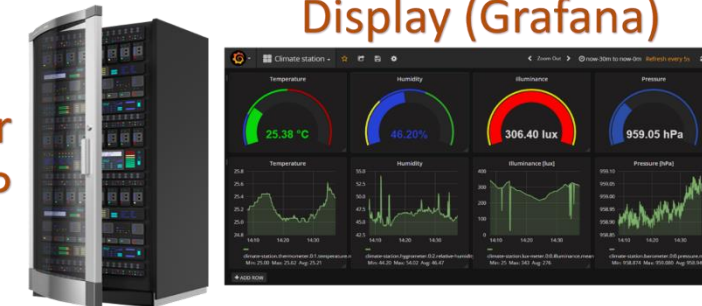
Easy to measure consumption of all sensors :



Datacenter  
IP



Display (Grafana)



# PRODUCT MARKETING SHEET: SMART GATEWAY

The Smart Gateway receive data from Smart devices, Process Images, and share all theses informations through large network

04/22/2019 - 08:54 : Cabinet Cam 3 :  
Three clients are in the waiting room

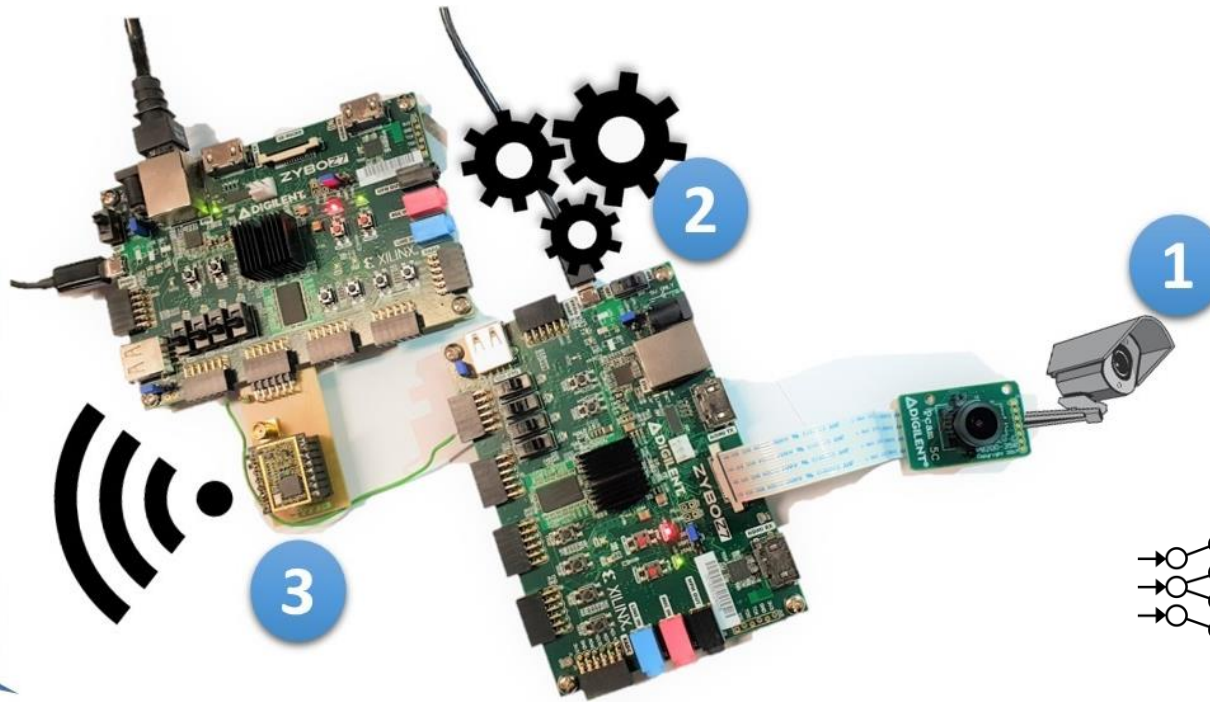
04/22/2019 - 13:54 : Maison Cam 4 :  
« Mimi » The cat just goes outside by the  
Kitchen window

04/23/2019

23/01/2019 - 08:13 : Cabinet Cam 2 :  
Door's Room n°5 has been opened by  
the secretary

Ask Cabinet Cam 2 :  
Someone in the Waiting room ?

04/23/2019 - 13:54 : Cabinet Cam 3 :  
Two clients are in the waiting room



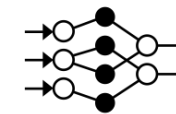
- Monitors and Informs users of events that happened, in **complete confidentiality**.



- Practice in **several** areas

- Ability to communicate with other Smart Cameras for an even **higher** level of monitoring and **security**.

- The SoC on the development board facilitates the integration of **Artificial Intelligence** into the system

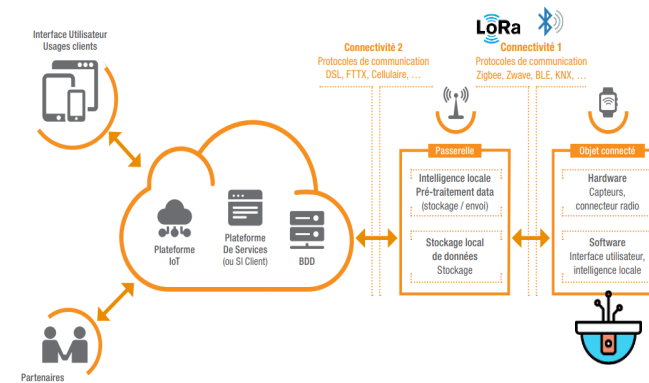


- Low memory** requirement due to internal image processing.



# SUMMARY

- Introduction
- Smart Sensor
  - Fonctionnalités
  - Design : Hardware
  - Design : Software
  - Result : Consumption test
- Smart Gateway
  - Overview
  - Applications
  - Component and Global Architecture
  - Hardware Design of Smart Camera
  - IP Design for LoRa Transceiver
- Conclusion



# CONTEXT

Surveillance

Industrial Project of the End of Studies

Radio communication

The French National Centre for Scientific Research (CNRS)

Confidentiality

Internet of Things(IOT)

Smart

Sensors

23,14 billion connected devices

Embedded Systemes

Laboratory of Computer Science, Robotics and Microelectronics of Montpellier(LIRMM)

Image Processing

IA

Security

Field-Programmable Gate Array (FPGA)

Communication Protocol for IoT

Long Rand Low Power Networks

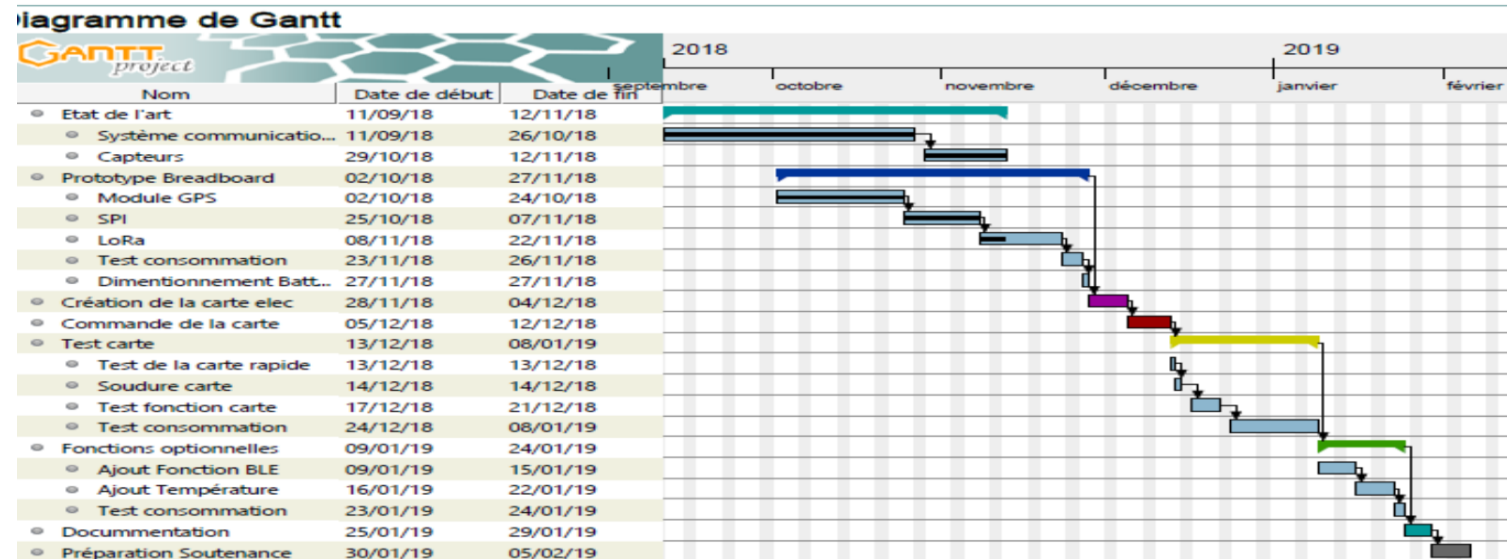
Surveillance

# INTRODUCTION

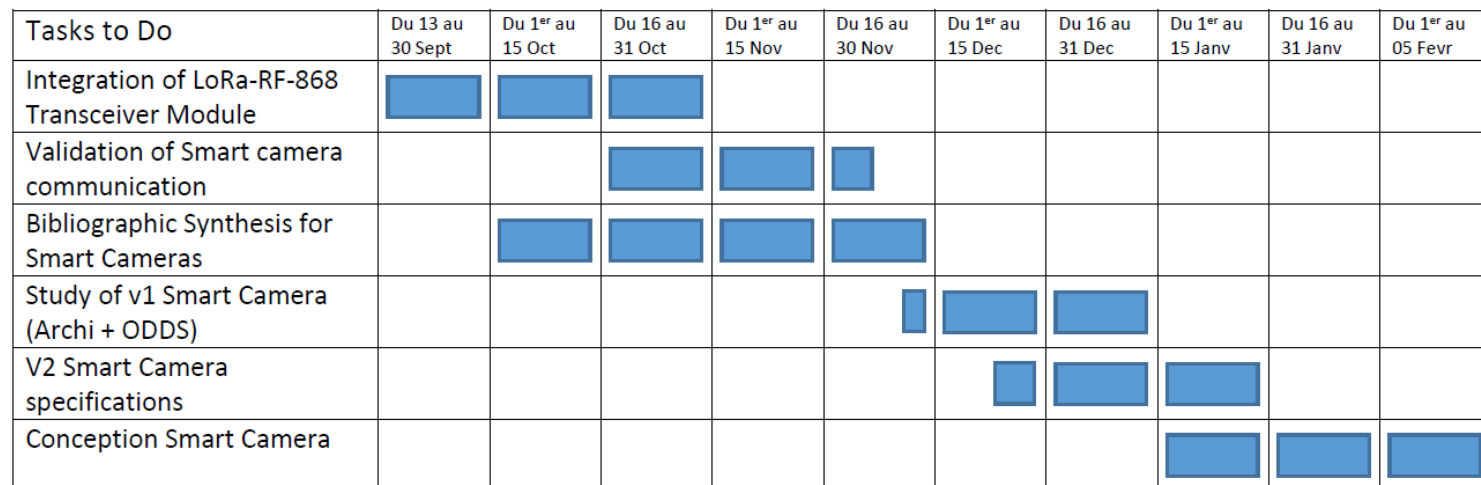
- Research about IoT
- Prototypes : The Smart Sensor and The Smart Gateway
- Objectives of the project: Create a Smart Gateway and Smart Sensor to establish connection between Device of Future to send/receive datas. Smart Sensor and Smart Camera.
- Tools Required
- Differents steps...

# SMART SENSOR : GANTT

Gantt Diagram for Smart Sensor Project



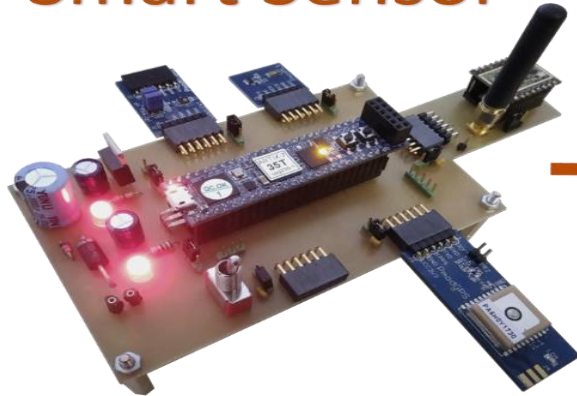
Gantt Diagram for Smart Gateway and Camera



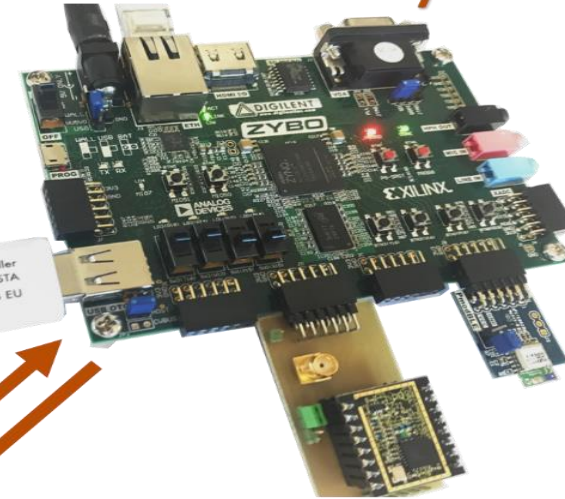


# SYSTEM

Smart Sensor



Gateway



Display (Grafana)



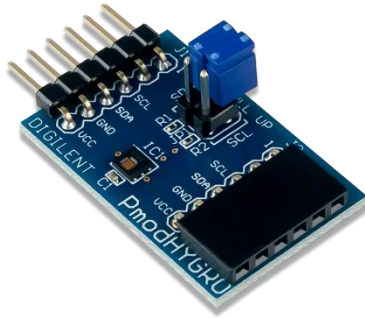
Datacenter  
IP



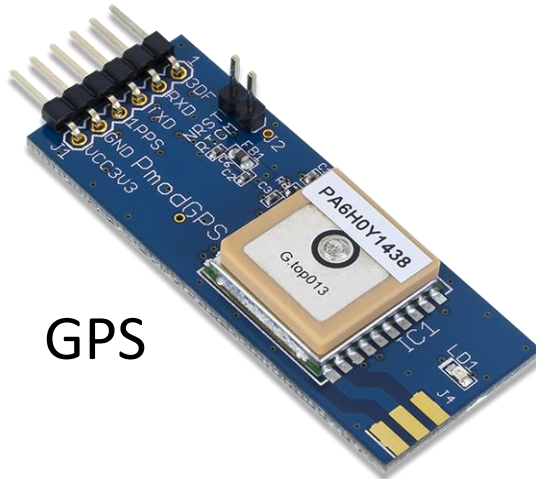
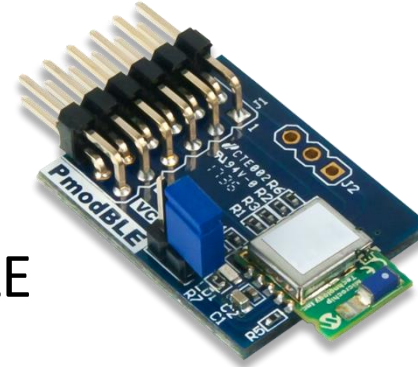


# SMART SENSOR : SENSORS AND RADIOS MODULES

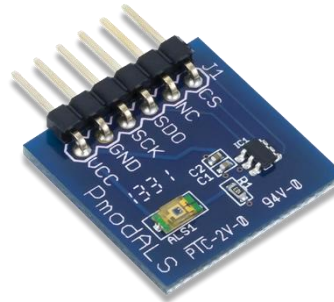
Temperature &  
Humidity



BLE

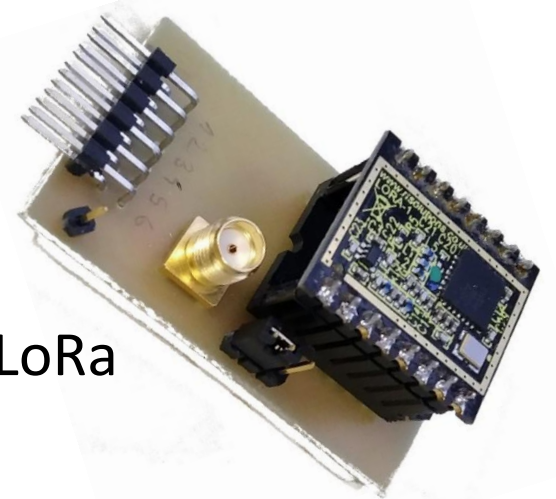


GPS

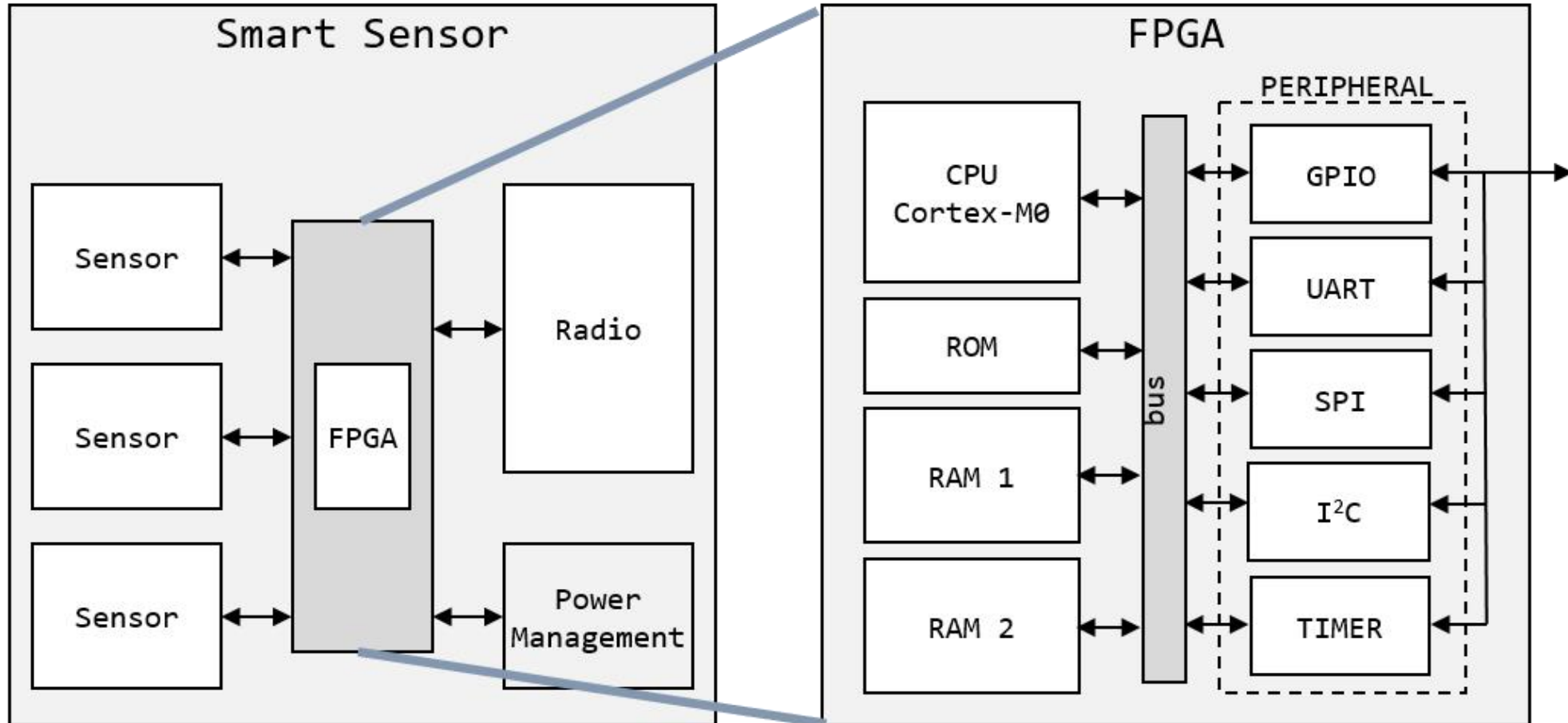
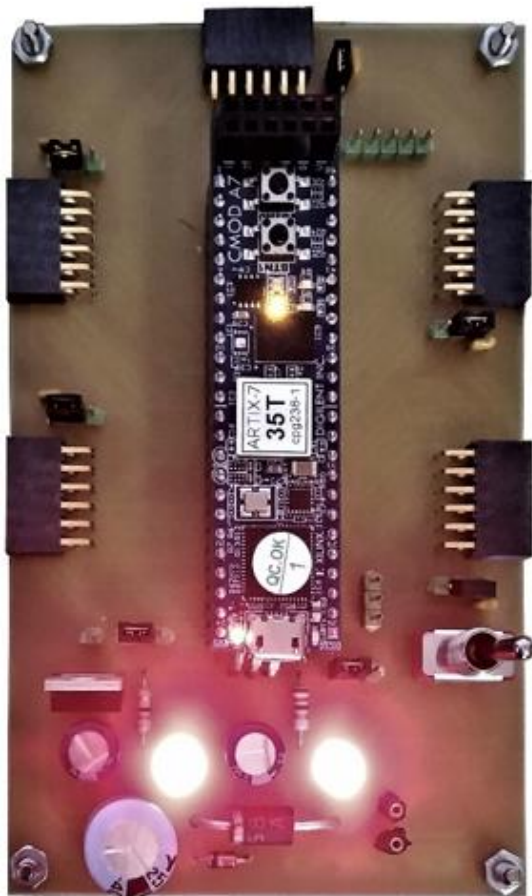


Brightness

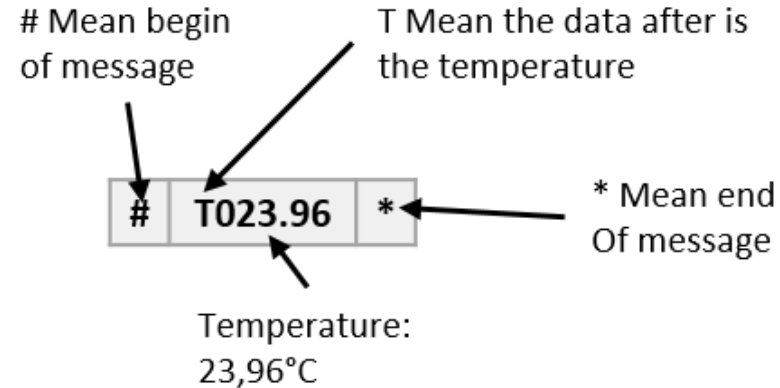
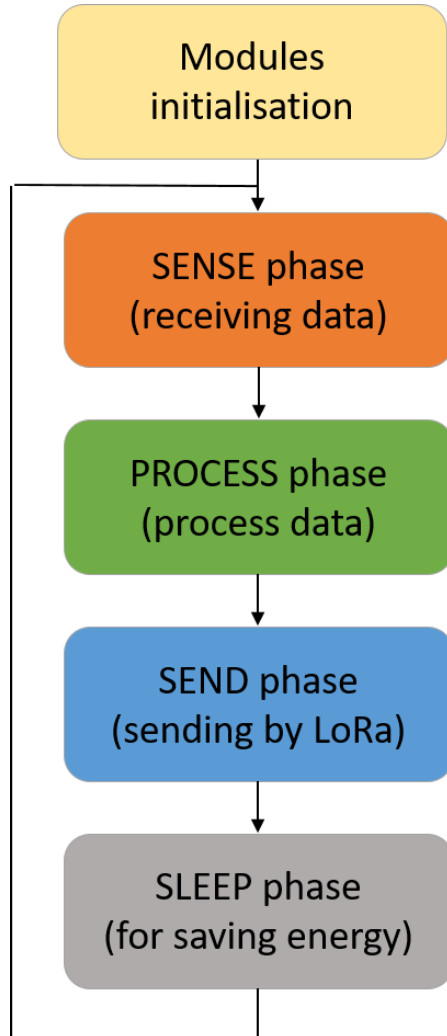
LoRa



# SMART SENSOR : HARDWARE DESIGN



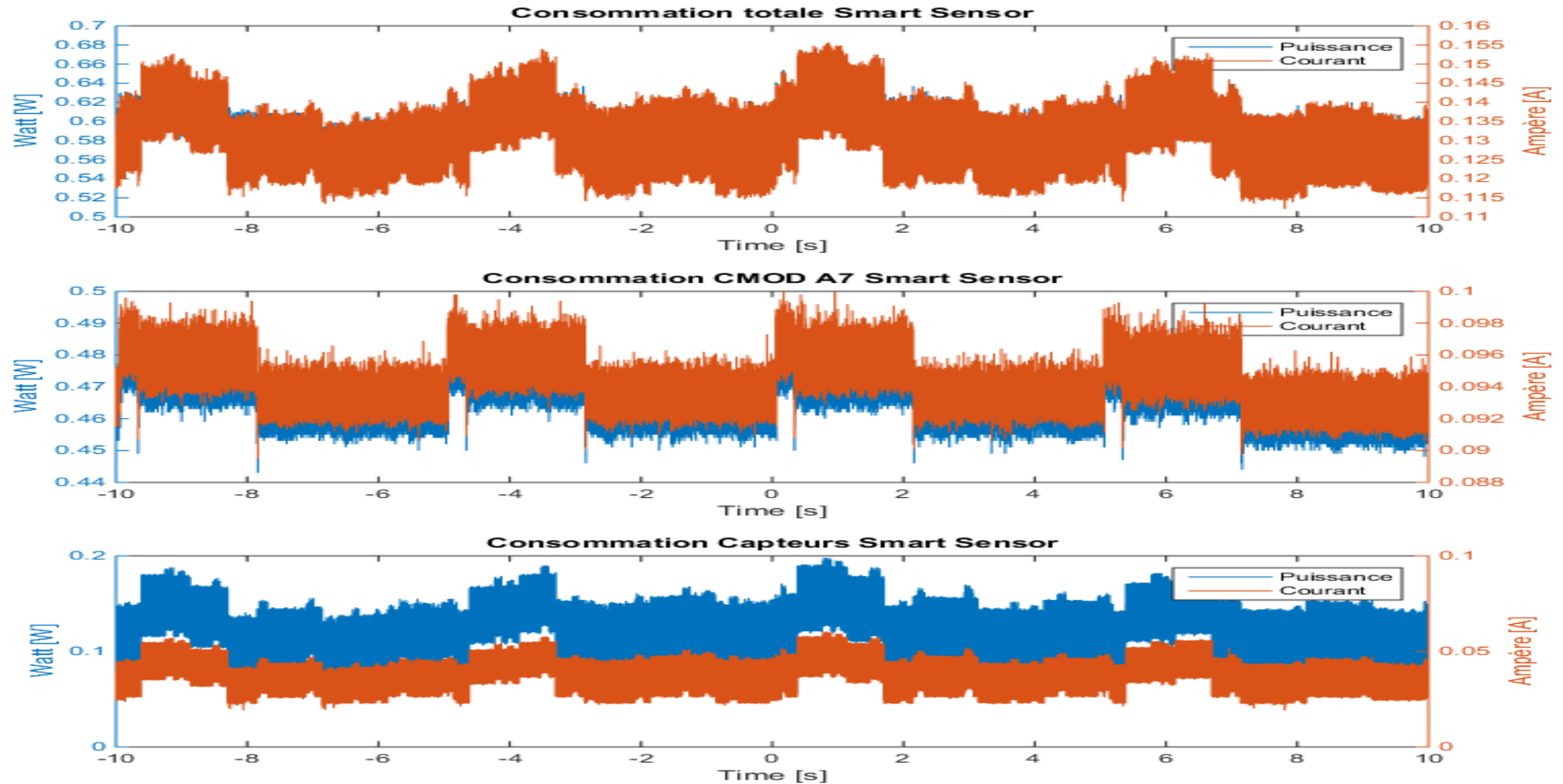
# SMART SENSOR : SOFTWARE DESIGN



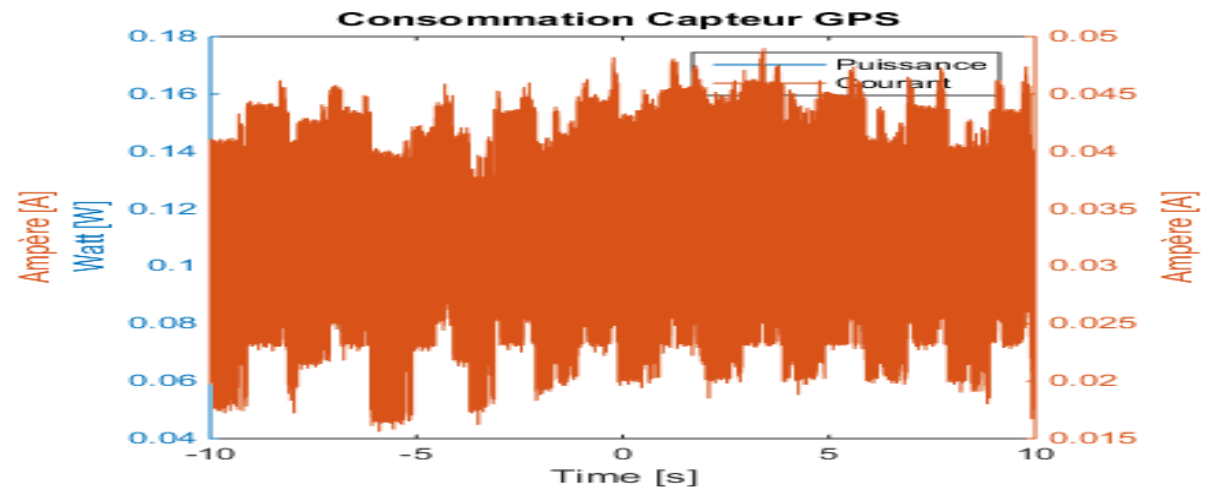
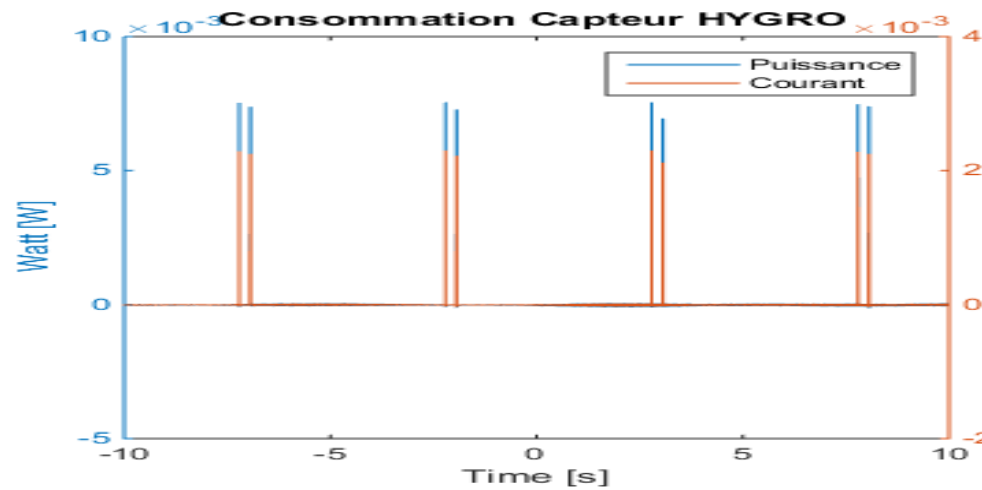
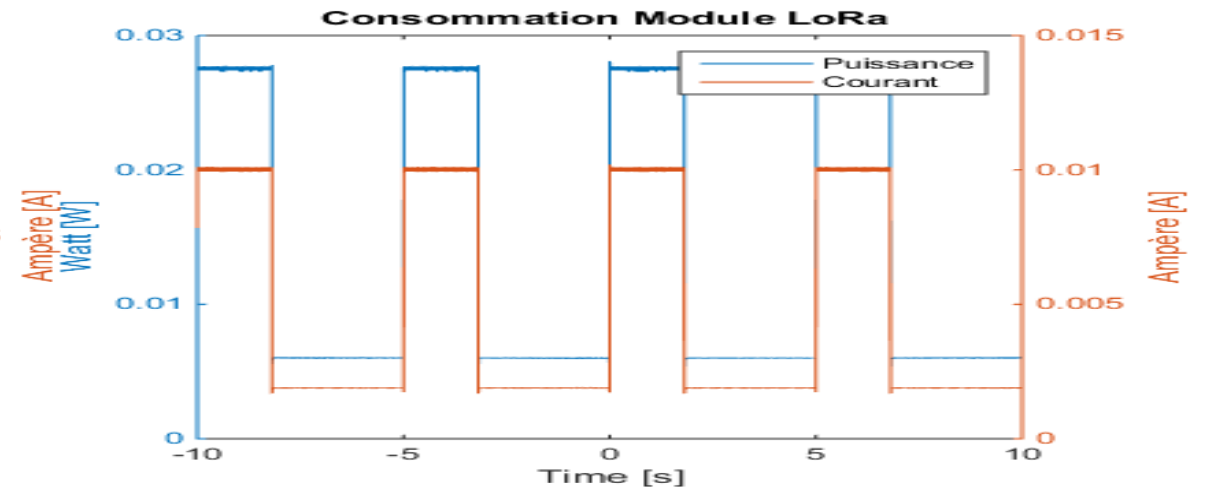
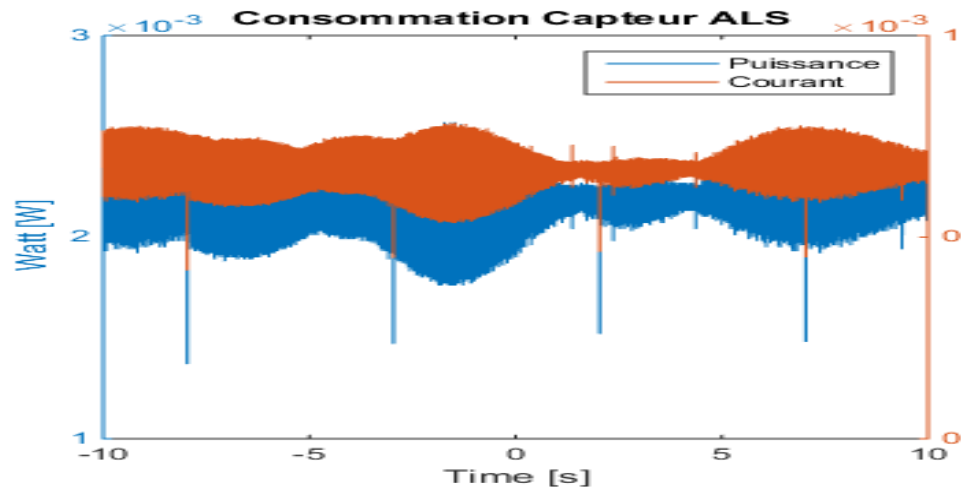
```
PHASE SEND
#H026.33,L003.13,T023.07,H082054,,D290119*

Humidité : 026.33 %
Luminosité : 003.13 %
Température : 023.07 °C
Heure : 08:20:54
Latitude : Pas de réseau GPS
Longitude : Pas de réseau GPS
Heure : 29/01/19
```

# SMART SENSOR : CONSUMPTION MEASURE

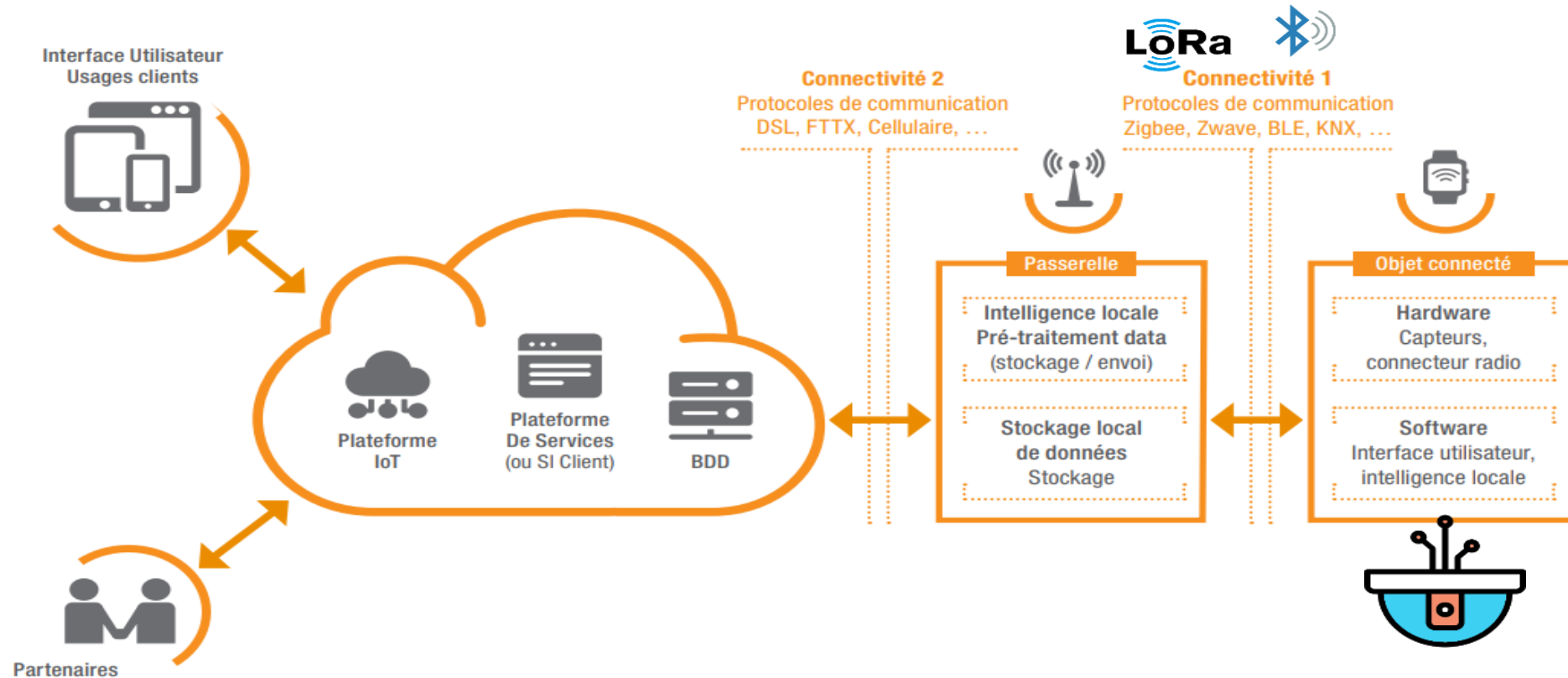


# SMART SENSOR : CONSUMPTION MEASURE



# SMART GATEWAY – SMART SENSOR & CAMERA

## Overview



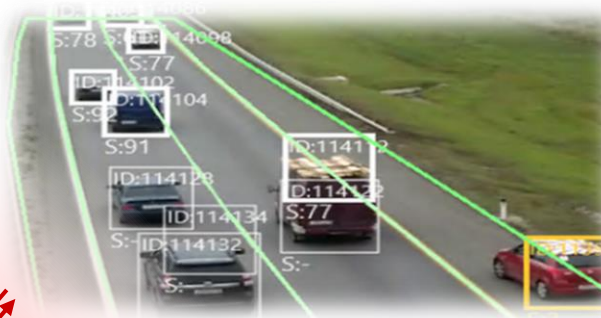


# SMART GATEWAY WITH CAMERA

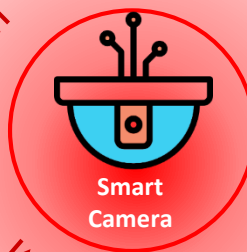
## Applications



**Smart Home**  
Surveillance intelligente  
intérieur/extérieur [2]



**Monitoring de la  
circulation routière**  
Smart Road [3]



**Surveillance milieu Agricole**  
(Agriculteurs et Eleveurs)

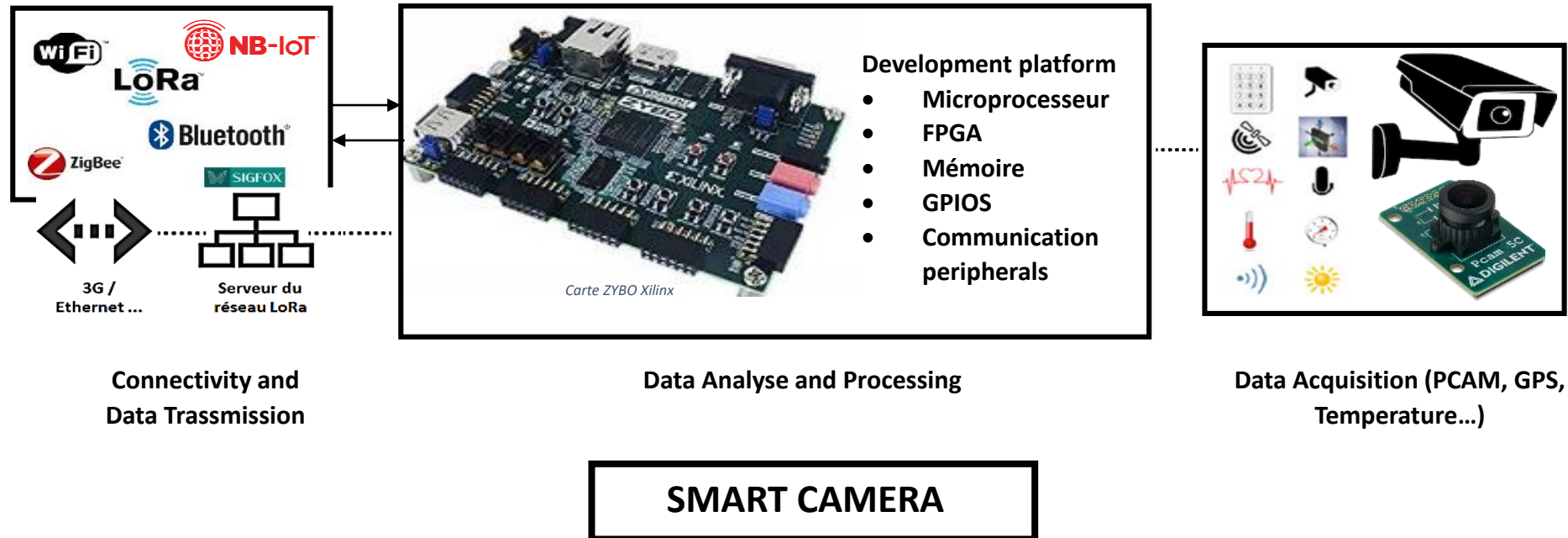


**Surveillance et Sécurité Milieu  
Industriel**



# SMART GATEWAY WITH CAMERA

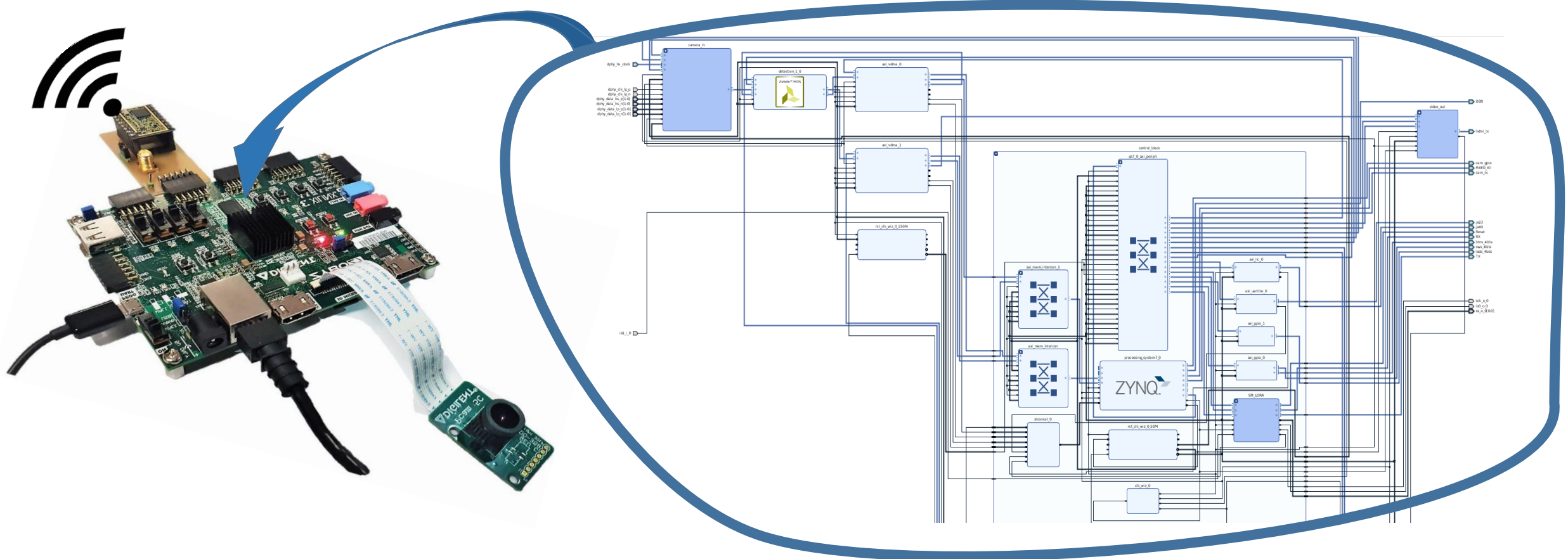
## Component and Design



- ❖ Image Acquisition
- ❖ Data Processing with several algorithms
- ❖ Transmission of pertinent informations

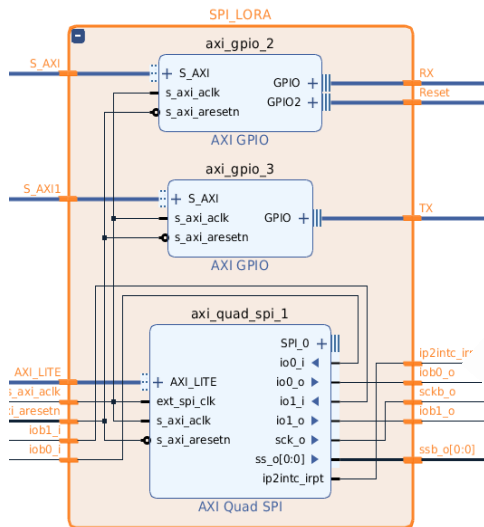
# SMART GATEWAY : DESIGN

## Hardware Desgin Smart Camera

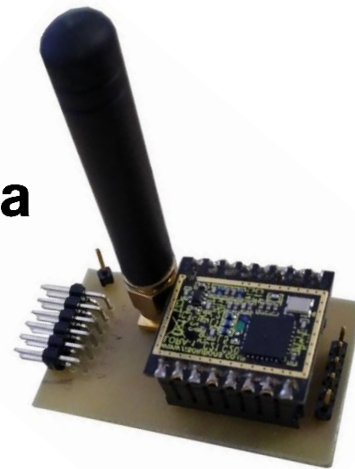


# SMART GATEWAY : LORA DEVICE

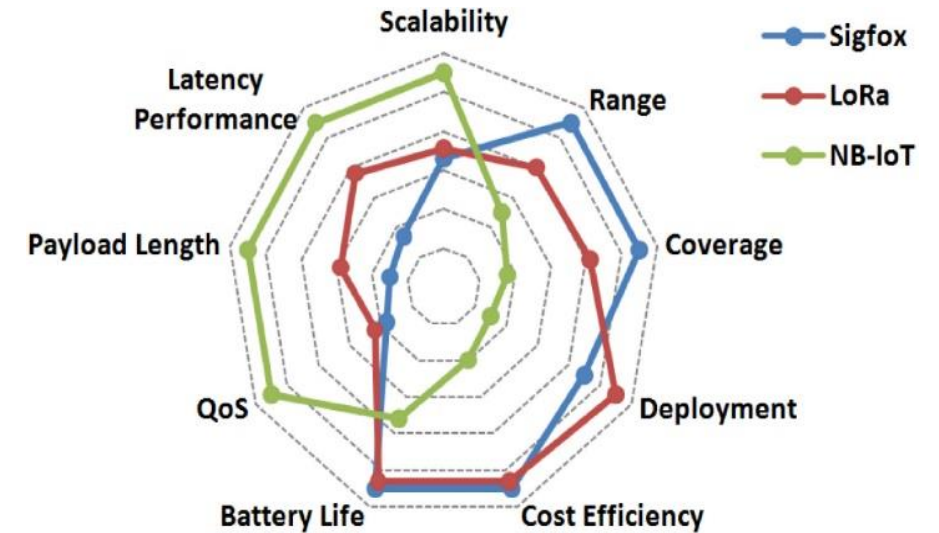
## IP Design for LoRa Transceiver



IP Block Design of PMOD LORA for ZYBO Z7



Pmod LoRa par Paul LELOUP.2019



Respective advantages of Sigfox, LoRa, and NB-IoT in terms of IoT factors. [1]

# DISCUSSIONS

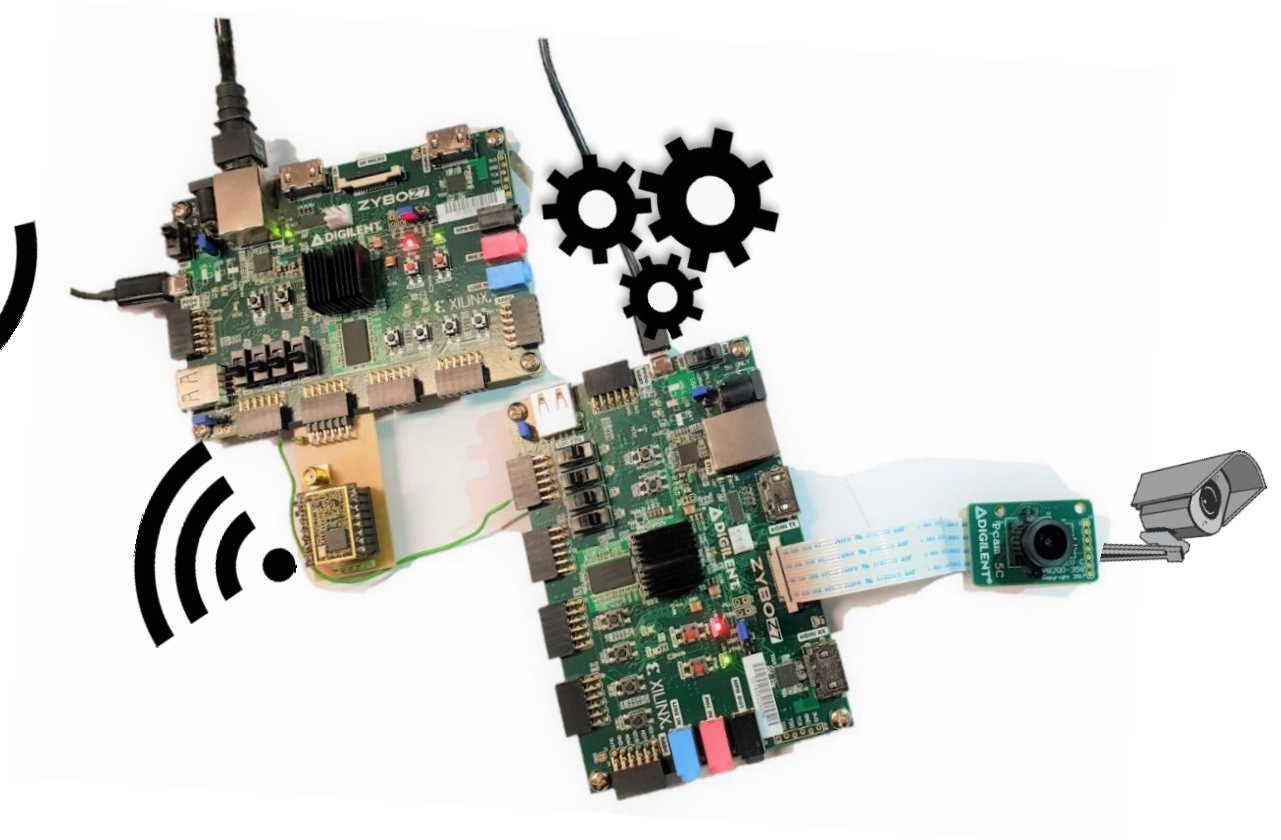
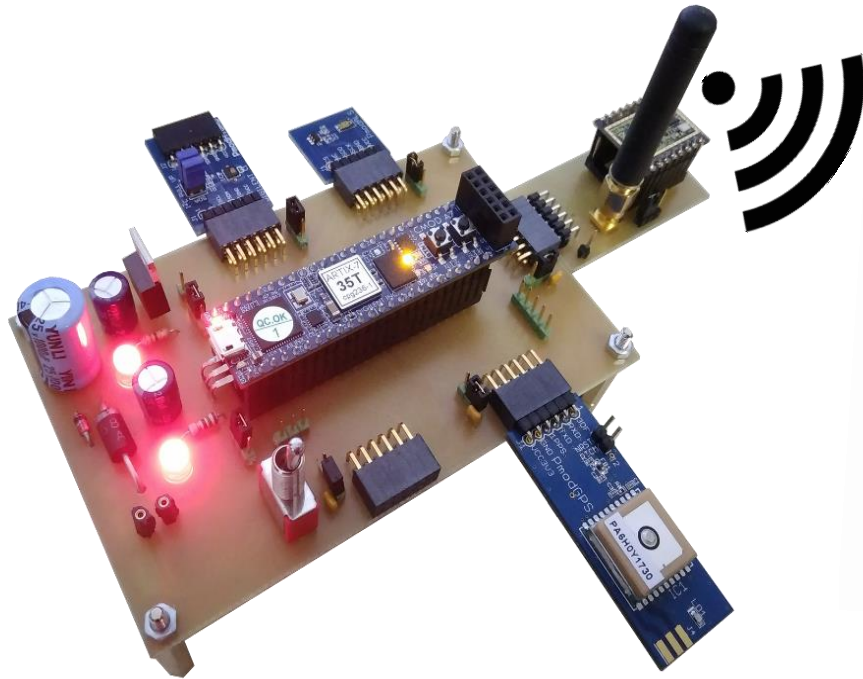
## **Problems encountered :**

- Some Fail in electronics cards
- Using Both Cortex A9 Cores of the ZYNQ with an AMP mode
- Configuration of the Semtech RF-LoRa-868-SO

## **Enrigneering Resources used :**

- Electronic card machine
- Computer
- Camera, Transceiver modules and Data Image Processing algorithmes

# DISCUSSION / CONCLUSION



# DEMONSTRATION

# Bibliography

[1] A comparative study of LPWAN technologies for large-scale IoT deployment

Kais Mekki, Eddy Bajic, Frederic Chaxel, Fernand Meyer. Research Centre for Automatic Control of Nancy, Campus Sciences.