Smart It Easy

Implementing Smart Building Technology

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1 : ECAM

Context : ECAM building

- ECAM building : combination of an **old** (80s) and a **new** building (10s) (Fig. 1)
- **Large spaces**: auditorium (300 seats), construction hall, offices and computer rooms
- **Poor energy and air quality management = unpleasant feeling** for people inside

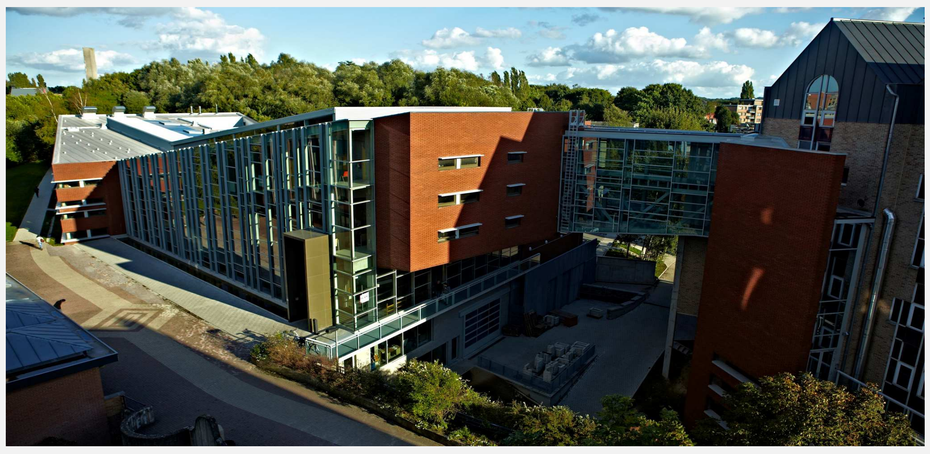


Figure 1 – ECAM (new building (l.), old building (r.))

Objectives : data collection/diagnosis/adjustment

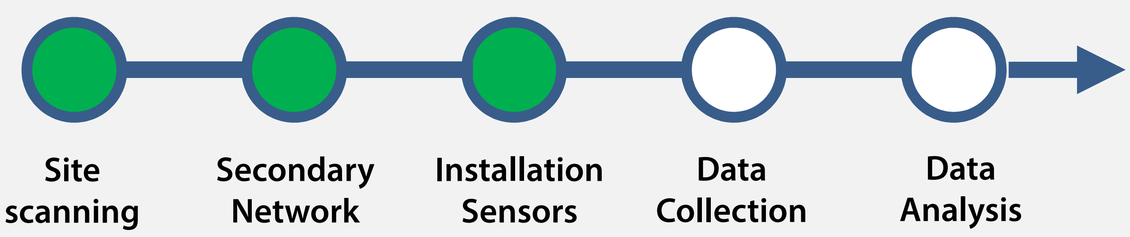
- **Data collection (T°, humidity, CO_2)**
- **Diagnosis**: characterizing the evolution of these indicators as precisely as possible (with additional sensors)
- **Adjustments** and suggestion for improving heat and air management of the building

Method

- **Selection** of most interesting rooms to analyze
  - Large auditorium, computer room, hallway
  - Selection criteria: diversity of thermic properties
- Creation of a **secondary network due** to complexity to integrate a solution in existing network
- **Data collection** on a custom platform
  - 80 sensors in 3 rooms
- **Data analysis and implementation of a day-to-day overview** (Fig. 2)

Figure 2 – Temperature data collected by sensors

- **Diagnosis**
- **Suggestion** for heat and air control improvement
- **Implementation** of solution



Protocol

- Sensors send data to their respective gateways (Fig. 3)

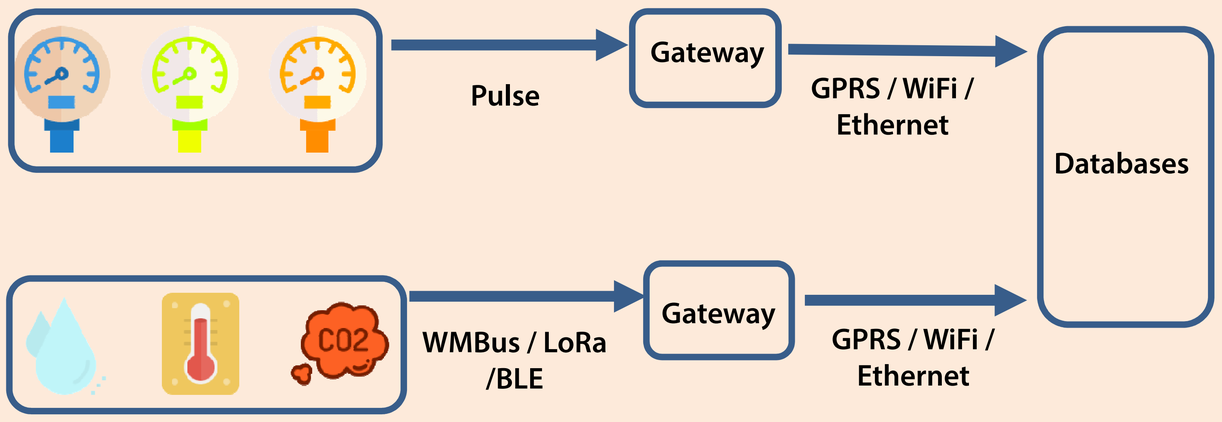


Figure 3 – IoT architecture

- Protocols used: **Wireless Mbus, LoRa and Bluetooth Low Energy** (Table 1)
- Creation of our own private LoRaWAN network and server (to be the unique owner of all data in partnership with GM Electronics)
- Data forwarded through **GPRS, WIFI and Ethernet** depending on the gateway location, network and availability
- Data centralization and analysis: development of a **microservice architecture with a rest api** to address the use of different types of databases (Mysql Influxdb)

Techno	Sensor type	Data rate	Broadcast range	Autonomy	Deployement difficulty
WM Bus	T° and H (static)	10 - 100 Kbps	In : 100m Out : 500m	5 years	medium
LoRa	CO2	0.1 - 50 Kbps	In : 1Km Out : 15Km	10 years	hard
BLE	T° and H (additional sensors)	1 - 3 Mbps	In : ≤100m Out : 700m	2 years	easy

Table 1 – Protocol comparison

Next steps

1. Data collection (6 months)
2. Data displayed on a suitable **dashboard** (Fig. 2) in each room in real time
3. Data analysis models **assessment** with former/current dataset
4. Use of **machine learning algorithms** to create predictive models and suggestions
5. Creation of a survey on thermal comfort

➔ Collected votes used to optimize models within the **PMV PPD framework**

6. Creation of an easy **solution** with Docker and configuration scripts running on Linux environments

Partnerships

Journée des Chercheurs en Haute École
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