Long Life Power Platforms for Internet of Things

KDT JU
KEY DIGITAL TECHNOLOGIES JOINT UNDERTAKING

EUROPEAN PARTNERSHIP

Project Overview

Pavel Smrz – Cognitechna/BUT, Czechia

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Project Aim

- **Energy harvesting** and **micro-power management** solutions for wireless IoT edge devices
- **Wireless sensors** are the key technology platform to enable us to collect data that will be used for **anomaly detection**, **efficiency**, and **performance monitoring**
- **Long battery life** sensors to be retrofitted on, in or near equipment and infrastructure:

  Asset tracking – optimise flow, management and throughput of assets

  Condition monitoring and **predictive maintenance** – maintenance overheads can potentially be reduced from 40% to less than 15%

  Energy efficiency and **comfort optimisation** – predict, understand, and adjust the energy load (e.g. equipment, buildings)

Challenges

- Total cost of ownership (TCO) of an industrial wireless sensor node, the battery handling and replacement costs typically amounts to **over €2000** over the sensor node's lifetime
- The equivalent TCO for a self-powered wireless sensor node amount to **€200- €700** – RoI around the time of the first battery replacement
- Battery life for wireless sensors is typically **12-18 months** relating to three significant **impediments**:

  Lack of autonomy – retrofit value propositions are not viable due to the overhead cost, maintenance, logistics and downtime of the sensors

  Environmental – by 2025, 70M batteries/days will be disposed of in landfill from IoT applications alone (sourcing of material for batteries also an issue)

  Inadequate sensing – applications at the moment require high resolution data which can be power demanding and/or require many sensing units

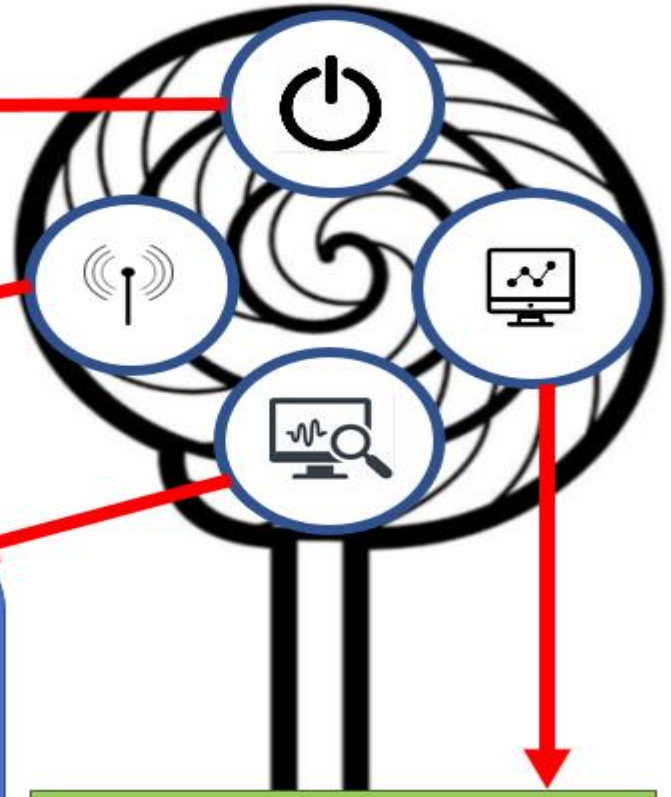
Overall Picture

LoLiPoP Power Source
Energy Harvesting
Storage
Power Management
(PMIC & discrete circuits)

Wireless IoT Edge Device
Micro-controller, sensors, Transceivers, wireless architecture

Source: pattiengineering.com

LoLiPoP Predictive Maintenance/Asset Tracking
Factory & Commercial Building Use Cases
Algorithm Development

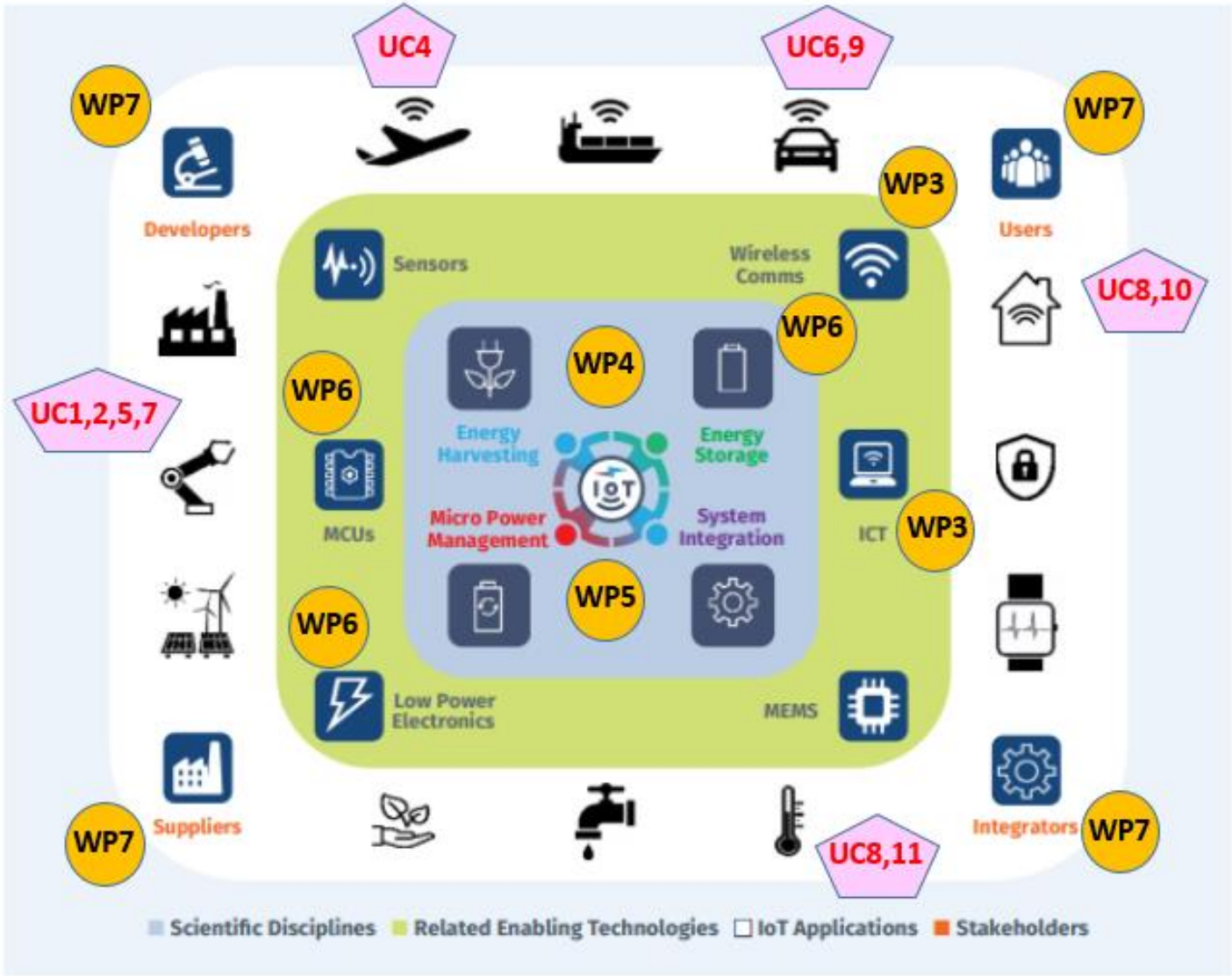


LoLiPoP Simulation Tool
IoT device power consumption
Energy Harvesting, Storage
Power Management
Ambient Energy Assessment

Research Goals

Grand objective	Measure of success
Provide **long battery life** solutions for the trillion sensor economy	Battery life **> 5 years** Typical **> 400% improvement** over commercial off-the-shelf solutions
Reduce amount of **batteries going into landfill**	Demonstration of **>80% reduction** in batteries being replaced
Improve ability to **track assets**, **predictive maintenance** of machinery & mobile assets, and energy efficiency and comfort in **buildings**	Successful retrofit of WSN modules, improved ability to track assets, ability to predict failure from data and monetised saving (typ. target **>20%**)
Create a series of **interoperable technology platforms**	Evidence of **use across** multiple component and modules

Mapping to the ecosystem



Use Cases

Functionalities

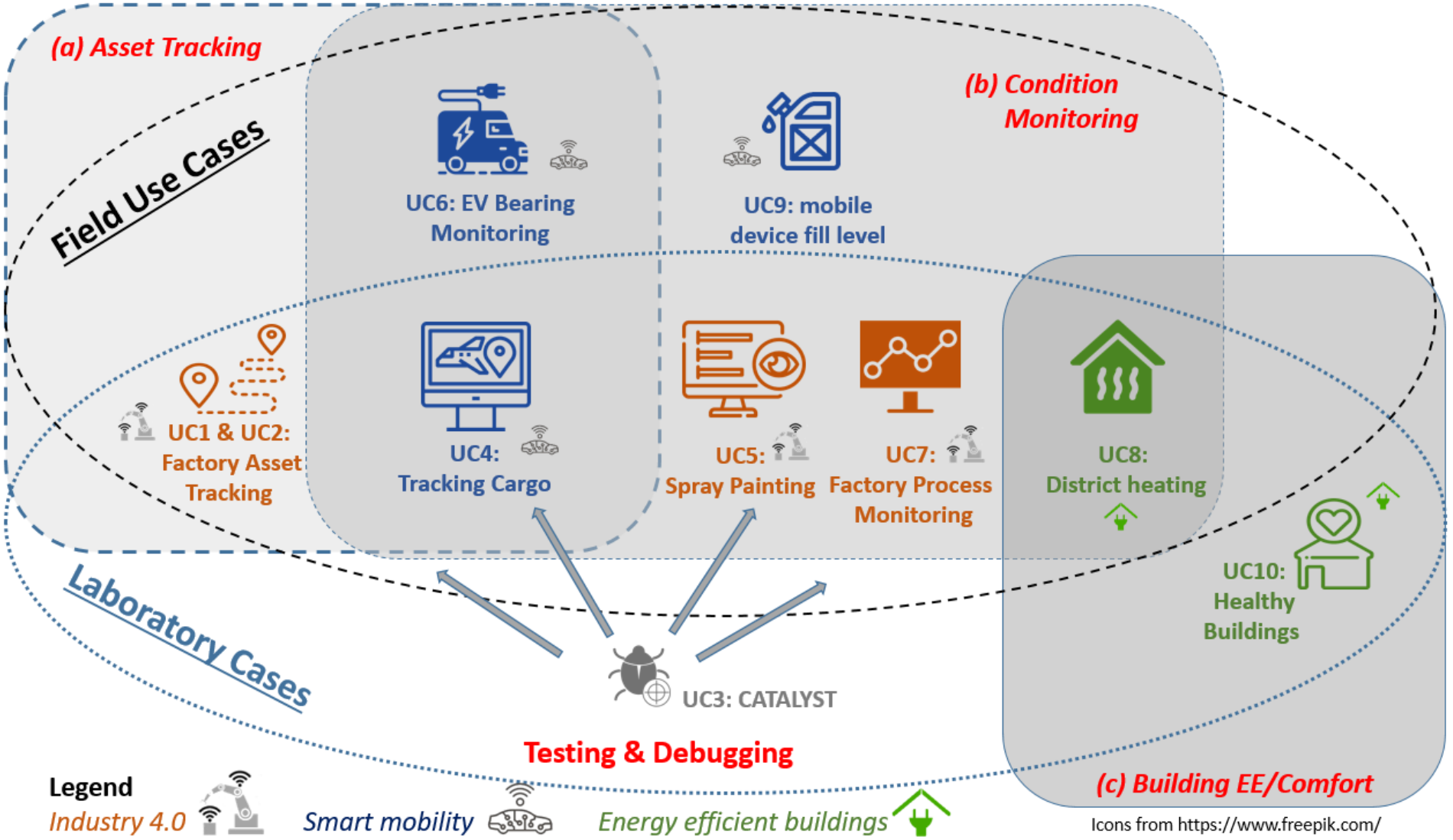
a) Asset Tracking

b) Condition Monitoring

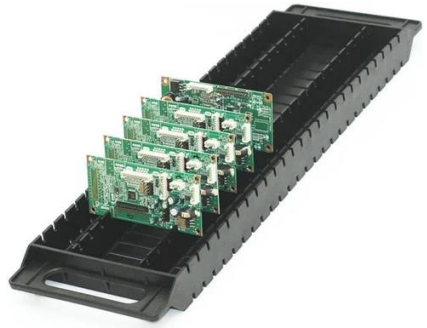
c) Building EE/Comfort

Applications

1. Industry 4.0
2. Smart Mobility
3. Energy efficient buildings



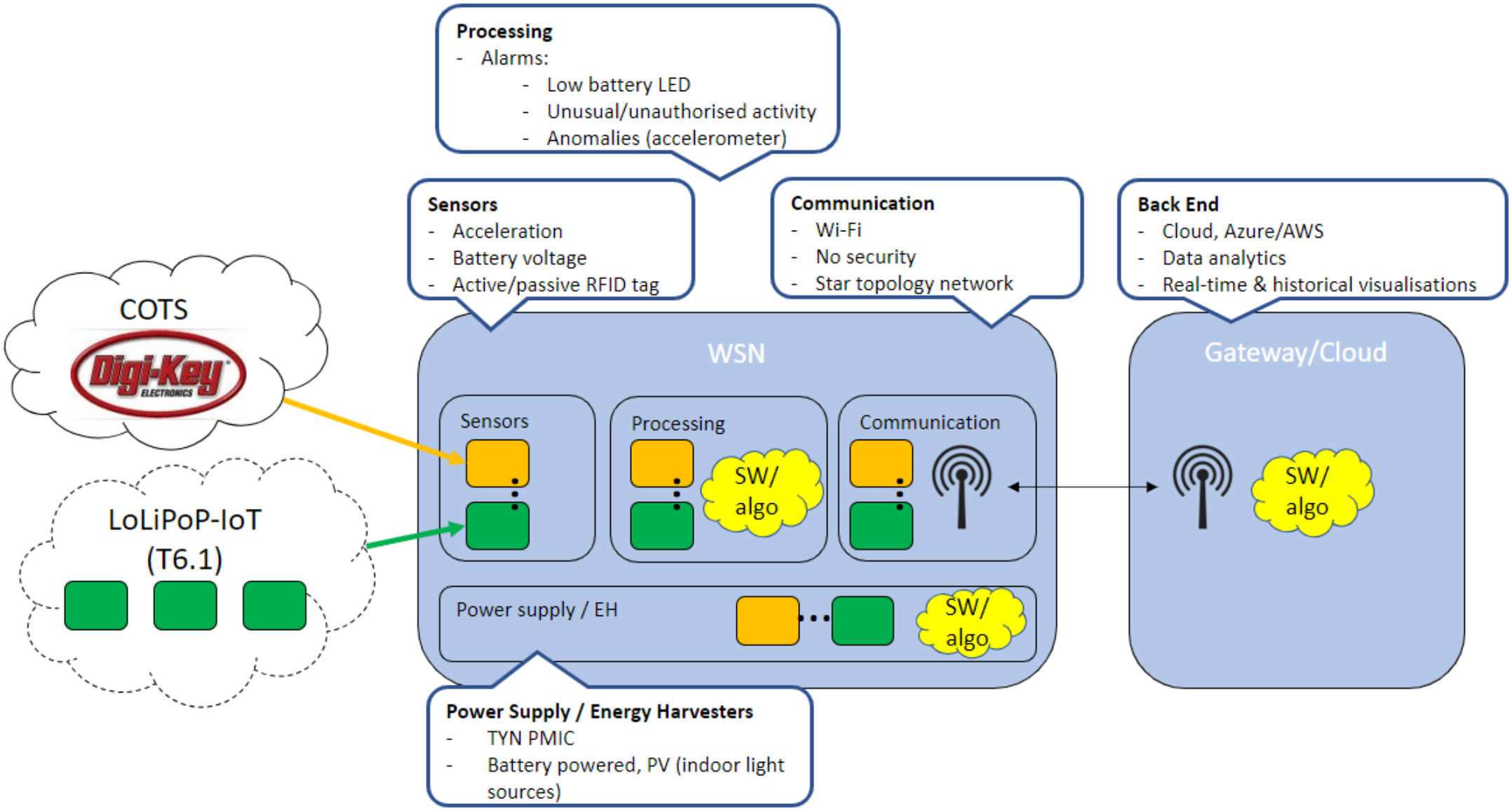
Use Case Example



› **Product sub-assemblies (BSC: PCBAs, PGs)**
  – Highly mobile assets, move through production flow
  – Controlled by MES
  – Experience bottlenecks
  – Sensitive to large forces
  – Can experience unusual/unauthorised activity (alarms)

› **Process equipment (not a BSC product: microscopes, barcode scanners)**
  – Typically fixed in place, not part of production flow
  – Not controlled by MES
  – Misplaced during calibration or line moves
  – Can experience unusual/unauthorised activity (no alarms)

Use Case Example



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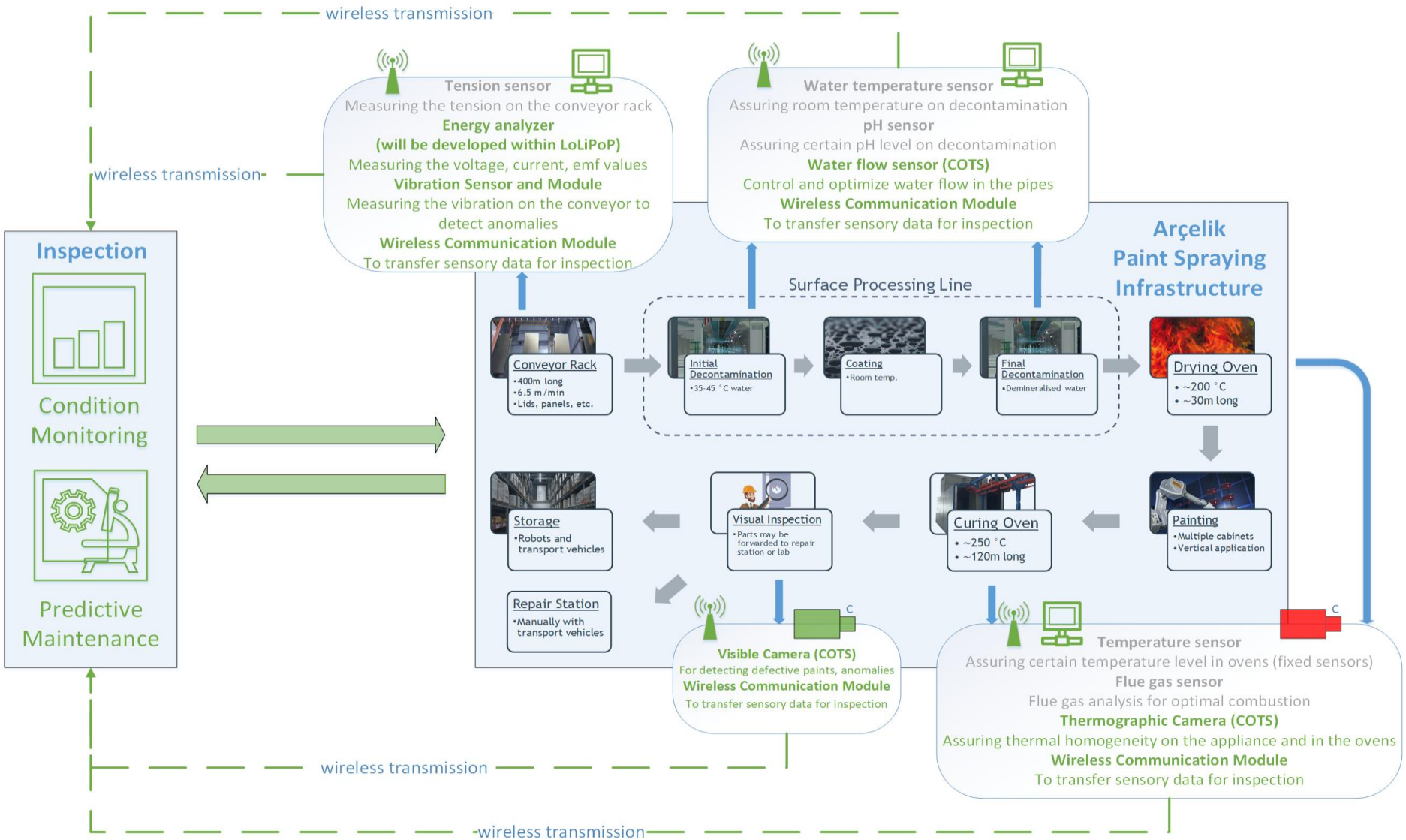

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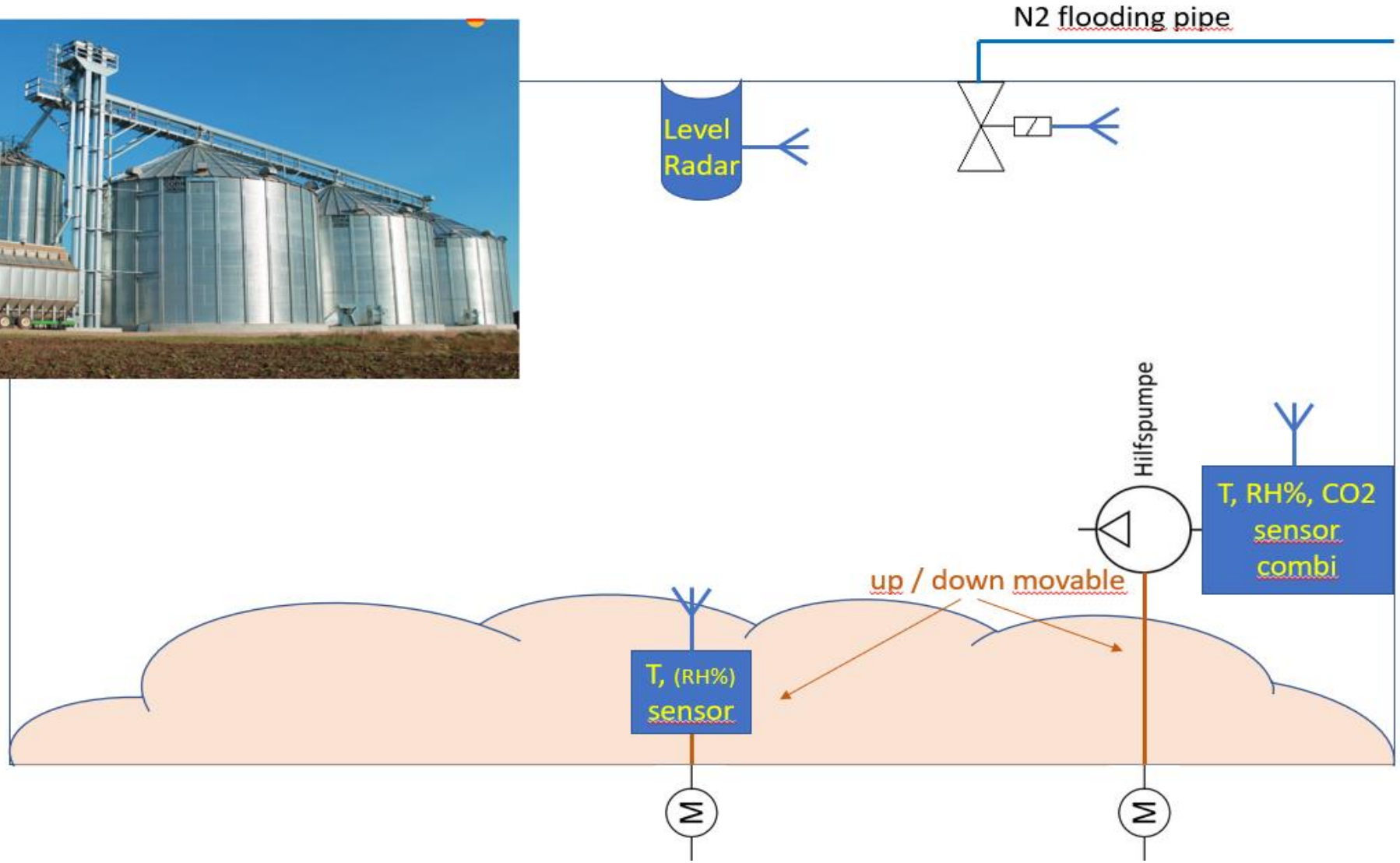

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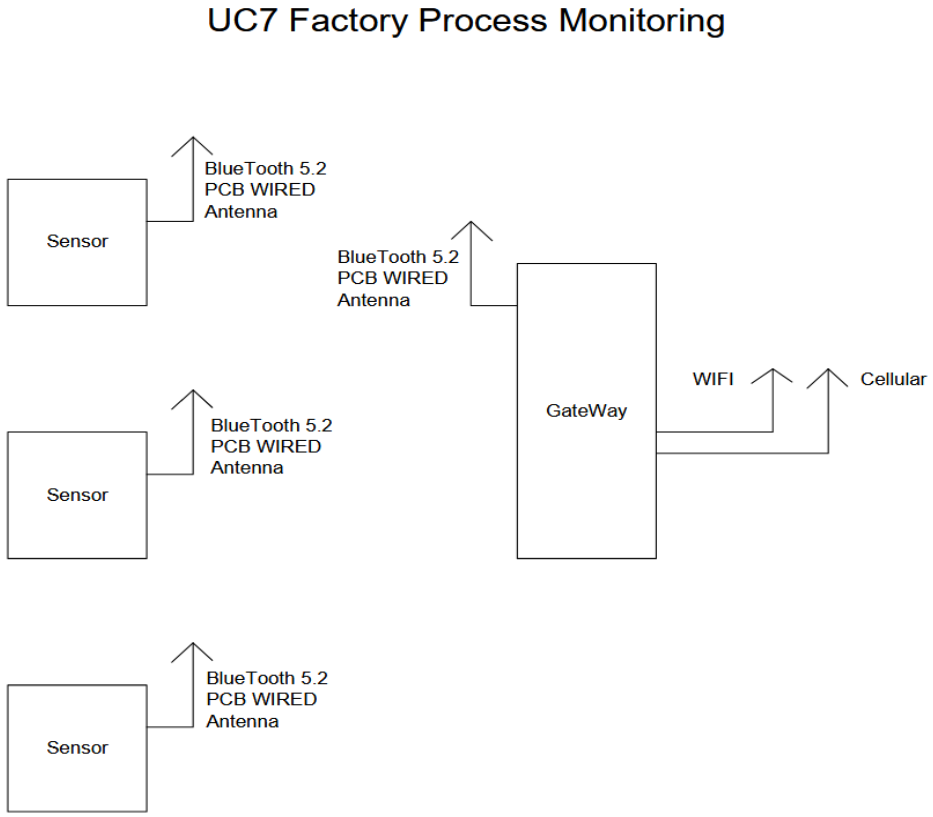

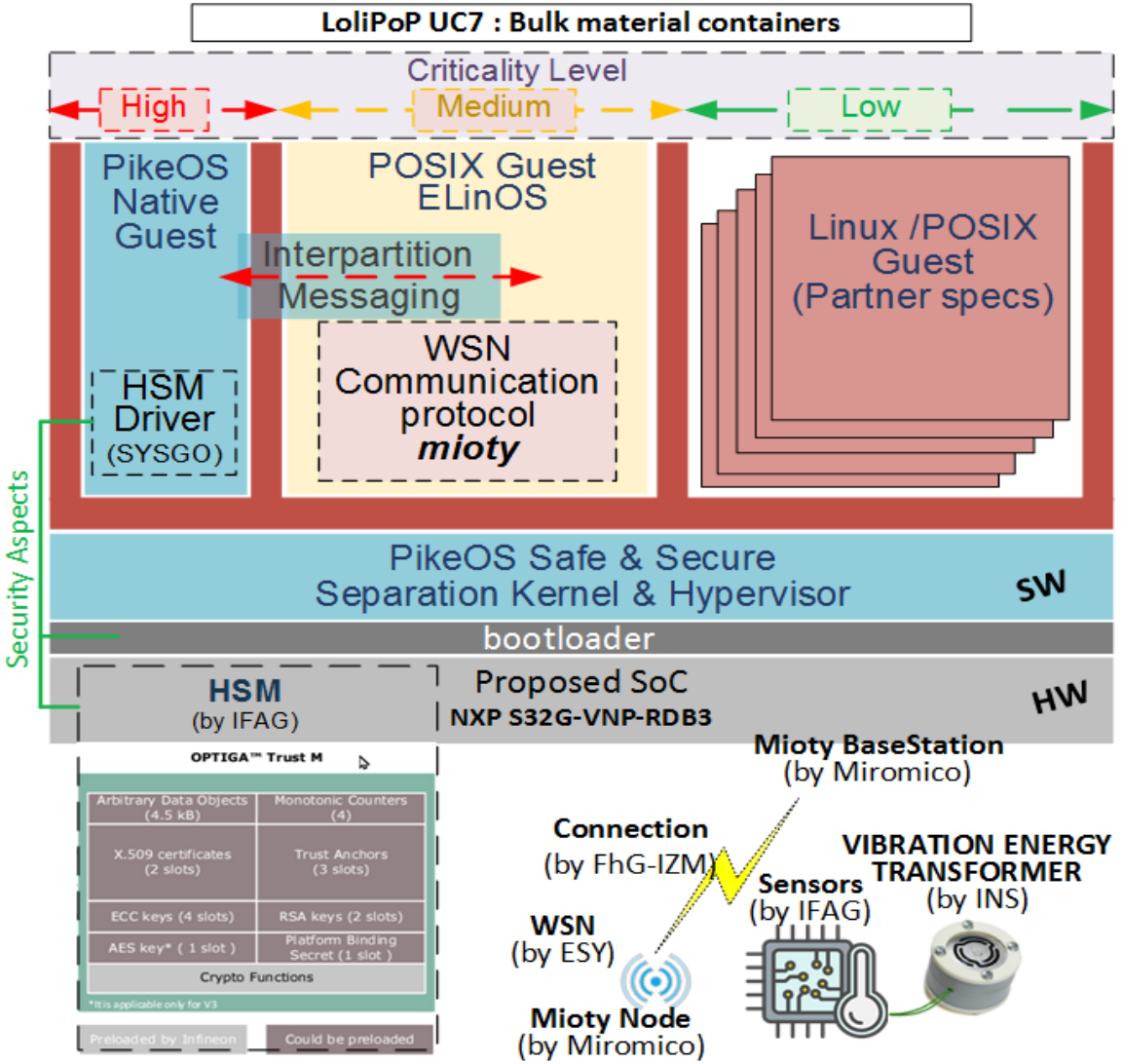

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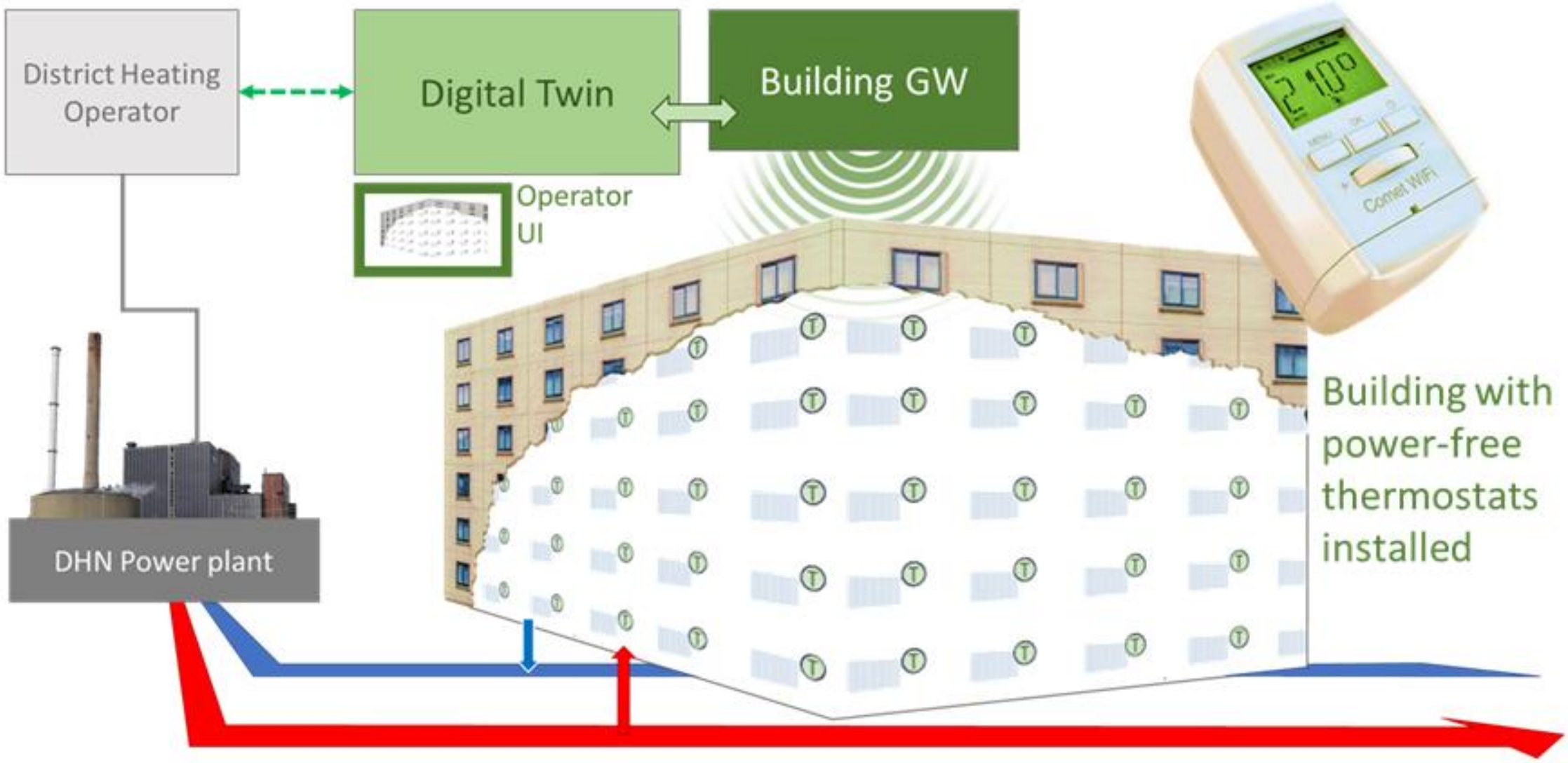

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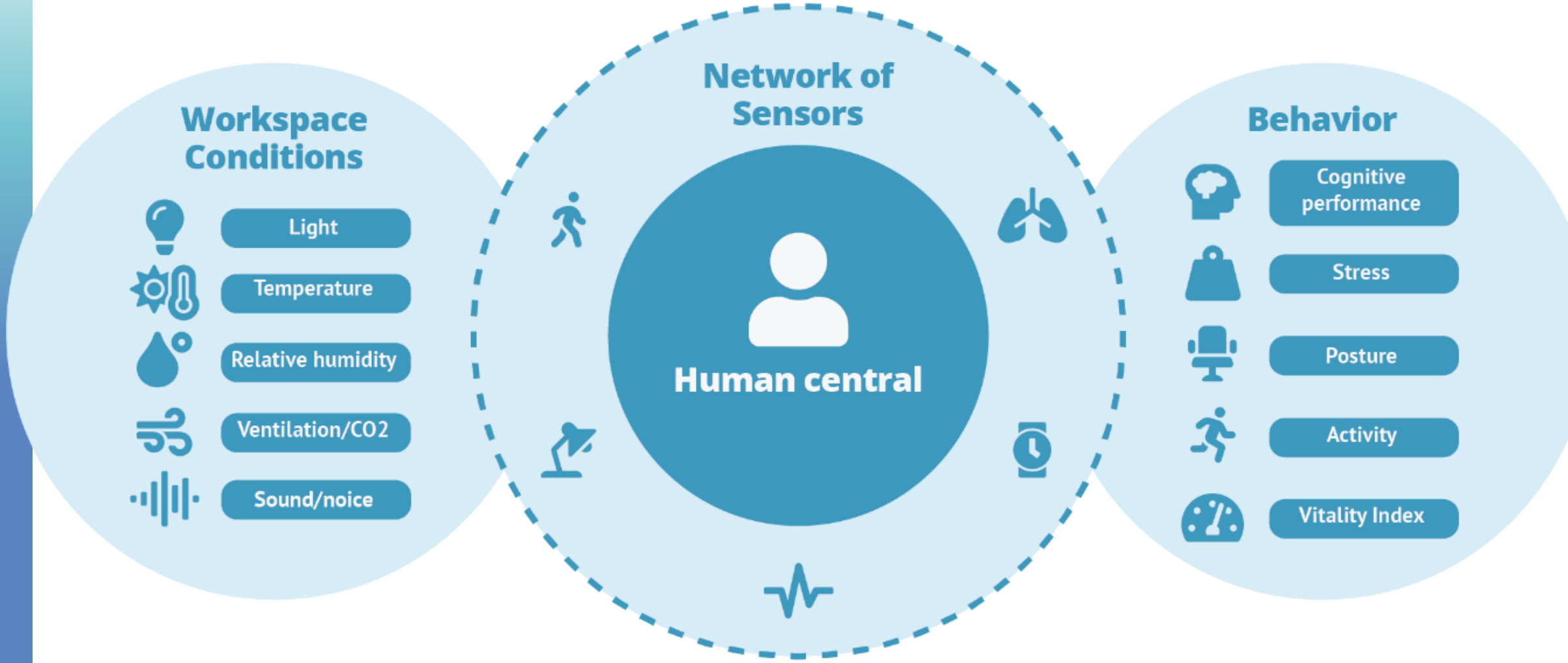

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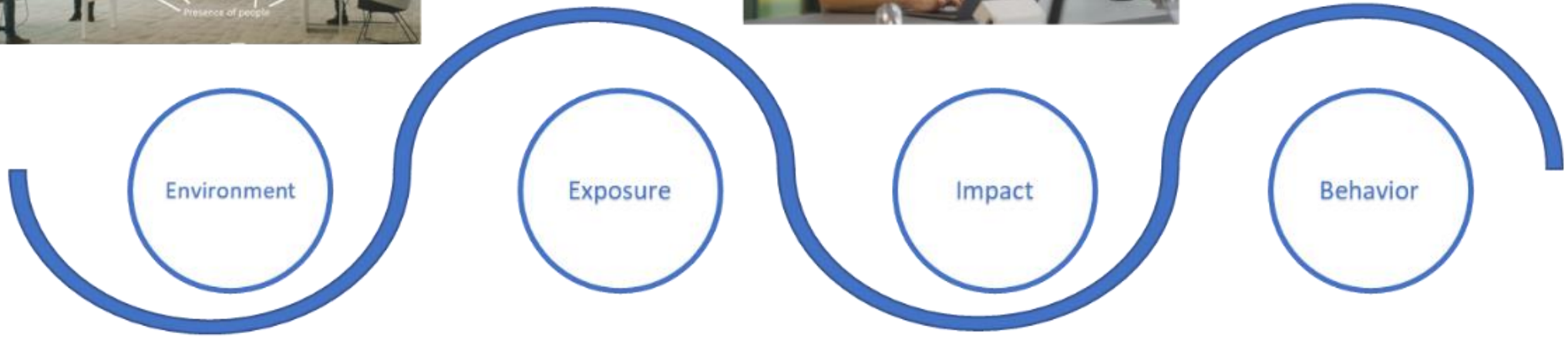

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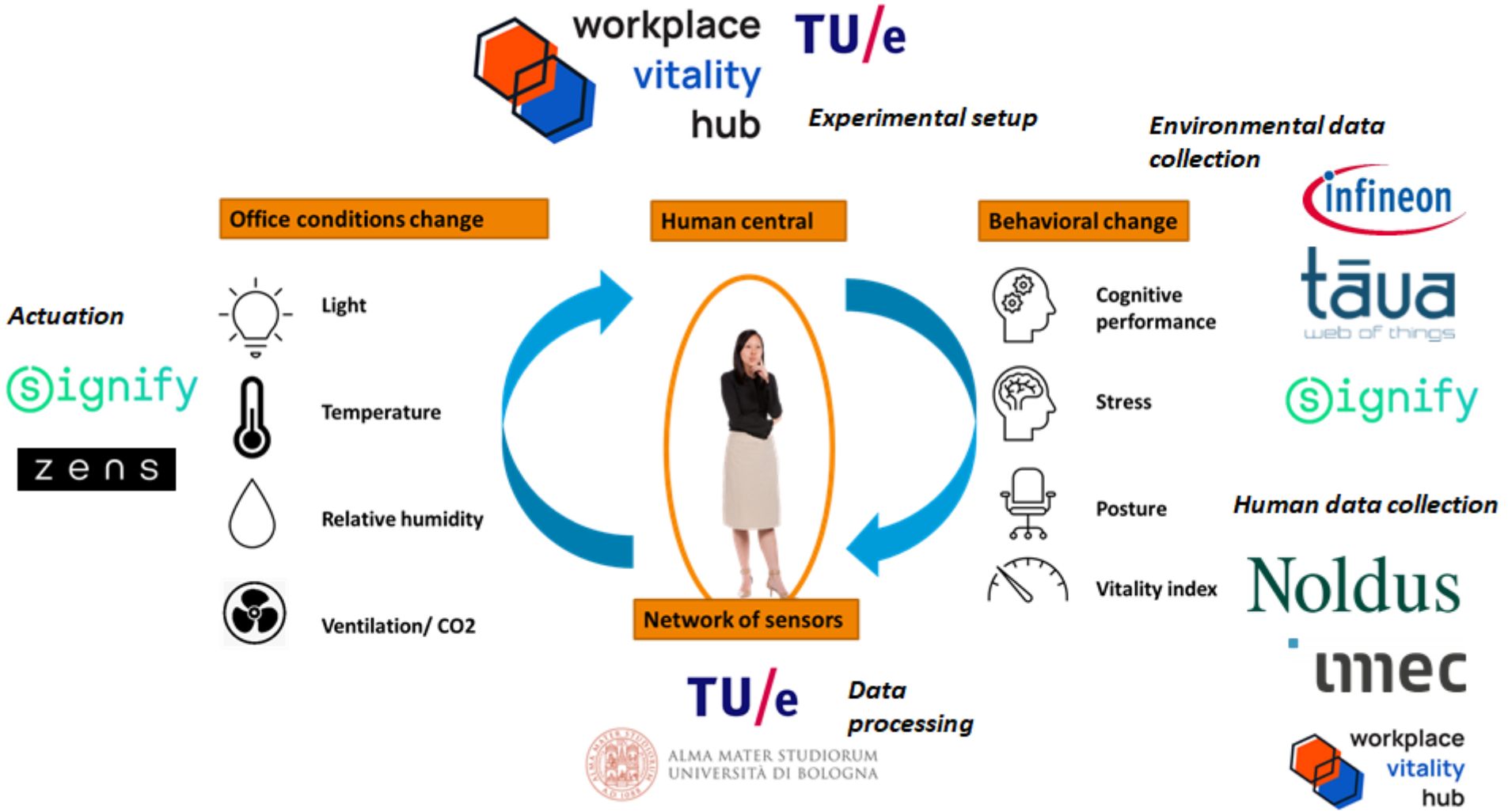

Current Work and Next Steps

- The LoLiPoP IoT is in the process of collecting use-case partner **requirements**
- The next step will involve finalizing **specification** of all components to be developed and defining **KPIs** relevant for **energy-aware** processes and **business impacts**
- Challenging discussions on the various **platforms** and their **inter-operability**
- **Simulation environments** and **digital twins** need to be prepared for developing algorithms before the infrastructure is ready
- An unified mechanism for **context sensitivity** aspects would be beneficial

Conclusions and Potential Collaboration

- **LoLiPoP IoT** project successfully started in **June 2023** and will soon submit initial deliverables
- The focus on **energy harvesting** and **ultra-low-power computing** makes it unique among KDT projects
- The **Edge-AI**-related aspects explored from the perspective of very **long battery life** makes the use of standard approaches challenging
- The project will organize an initial **dissemination workshop** in February 2024 – keep in touch via https://www.lolipop-iot.eu
- We would love to **cooperate** with other projects and coordinate various activities, for example, **dissemination** and **standardization**

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