AMANDA

The world in your hands

AutonoMous self powered miniAturized iNtelligent sensor for environmental sensing anD asset tracking in smArt IoT environments

The AMANDA Project

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CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

Information Technologies Institute

AMANDA project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 825464.

Our motivation

- The world is undergoing a digital transformation in common pursuit to innovate
- There is a growing need for a sophisticated approach to solve problems in:
  - **Smart cities:** Air quality monitoring, temperature, humidity, noise and occupancy
  - **People and asset security:** Imaging, tracking, fingerprint, data privacy, cybersecurity
  - **The Covid-19 pandemic**

- Imagine if there was an intelligent system with miniature dimensions and ultra-low-power consumption, that can be easily installed or used as a wearable and with a maintenance-free lifetime of more than 10 years!

The AMANDA project – a European multi-national collaboration

Partners: **8**

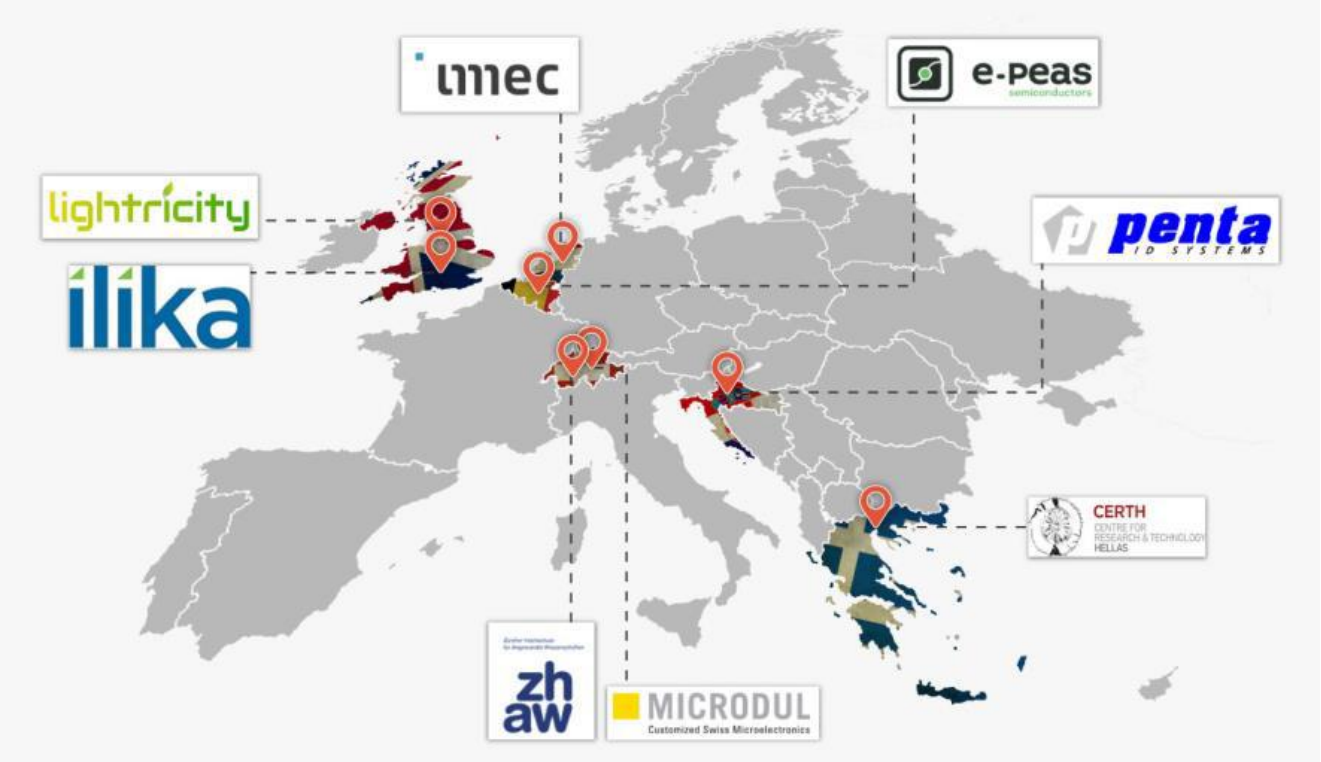
- Country Coverage: **6 Countries**
  - Belgium, Croatia, Greece, The Netherlands, Switzerland, UK

Academia

- Centre for Research and Technology Hellas [***CERTH***] (Greece)
- Stichting IMEC Nederland [***IMEC***] (The Netherlands)
- Zurich University of Applied Sciences [**ZHAW**] (Switzerland)

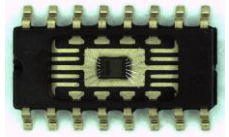
Industry partners

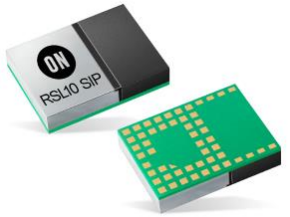
- Lightricity Limited [***Lightricity***] (UK)
- e-peas S.A. [***EPEAS***] (Belgium)
- Ilika Technologies Ltd [***Ilika***] (UK)
- Microdul AG [***Microdul***] (Switzerland)
- PENTA društvo s ograničenom odgovornošću za informatički inženjering [***PENTA***] (Croatia)



The AMANDA Concept

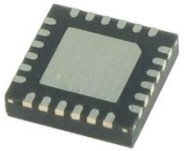
- **Miniaturization:** Design and develop a **miniaturized ASSC** with the **dimensions of a credit card** and a **3mm thickness**

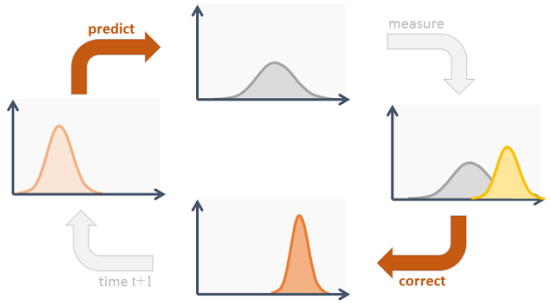




- **Develop advanced sensing technology:** Advanced miniaturized **multi-sensing** technology

- **Ultra-low power consumption and energy autonomy:** Ultra-low power electronics, energy harvesting and storage

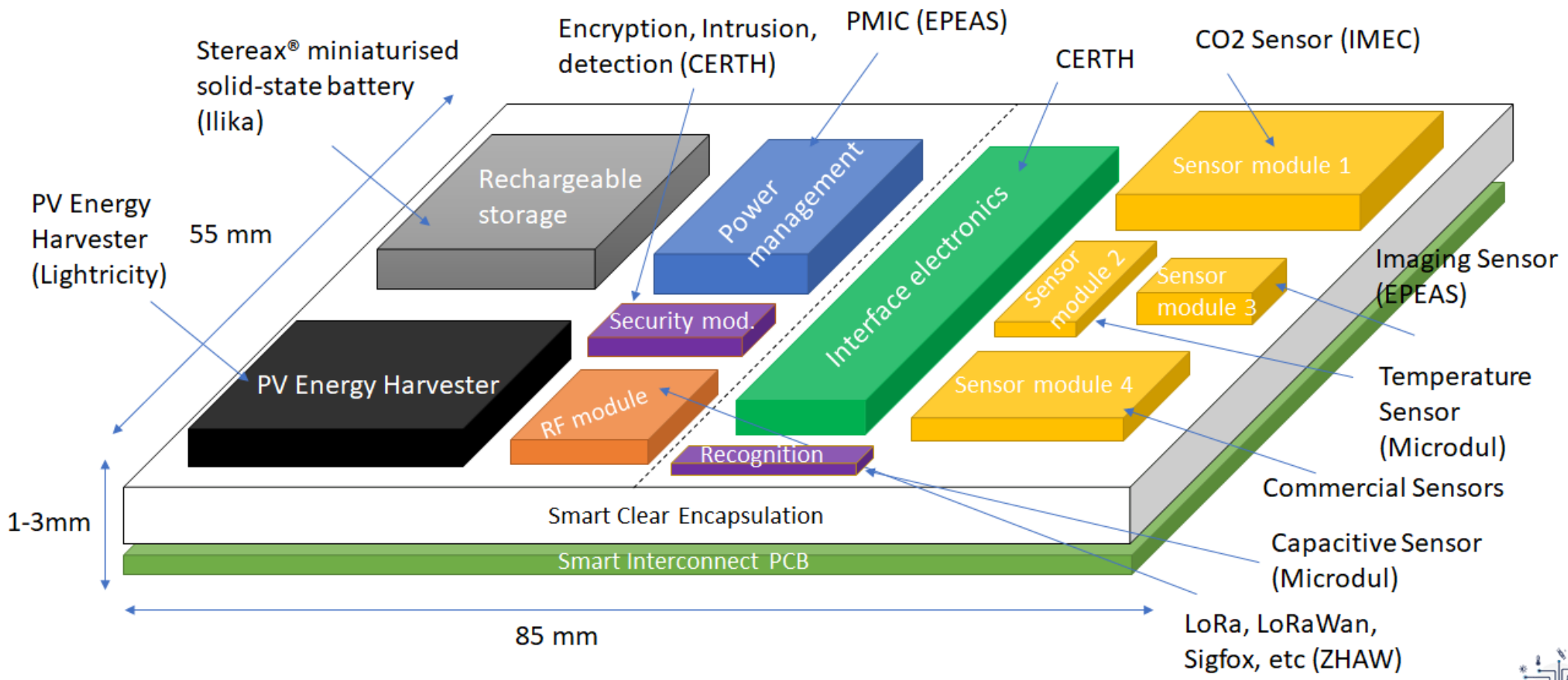




- **Wireless communication capabilities:** Short- and long-range communications, ultra-low power localization and tracking

- **Intelligence and data security:** Processing capabilities for **sensor/data fusion** and **low-power edge intelligence**

AMANDA conceptual view



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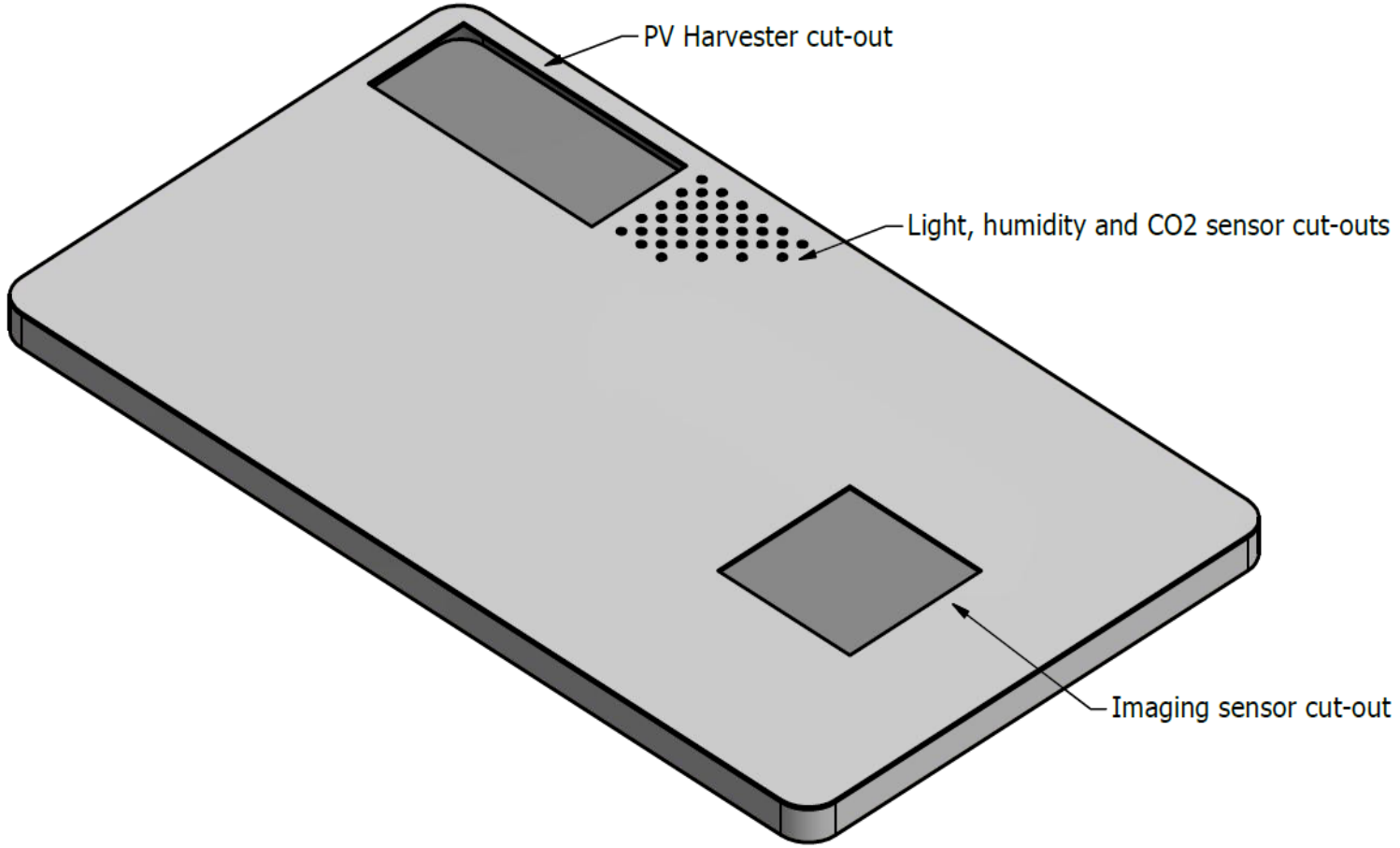
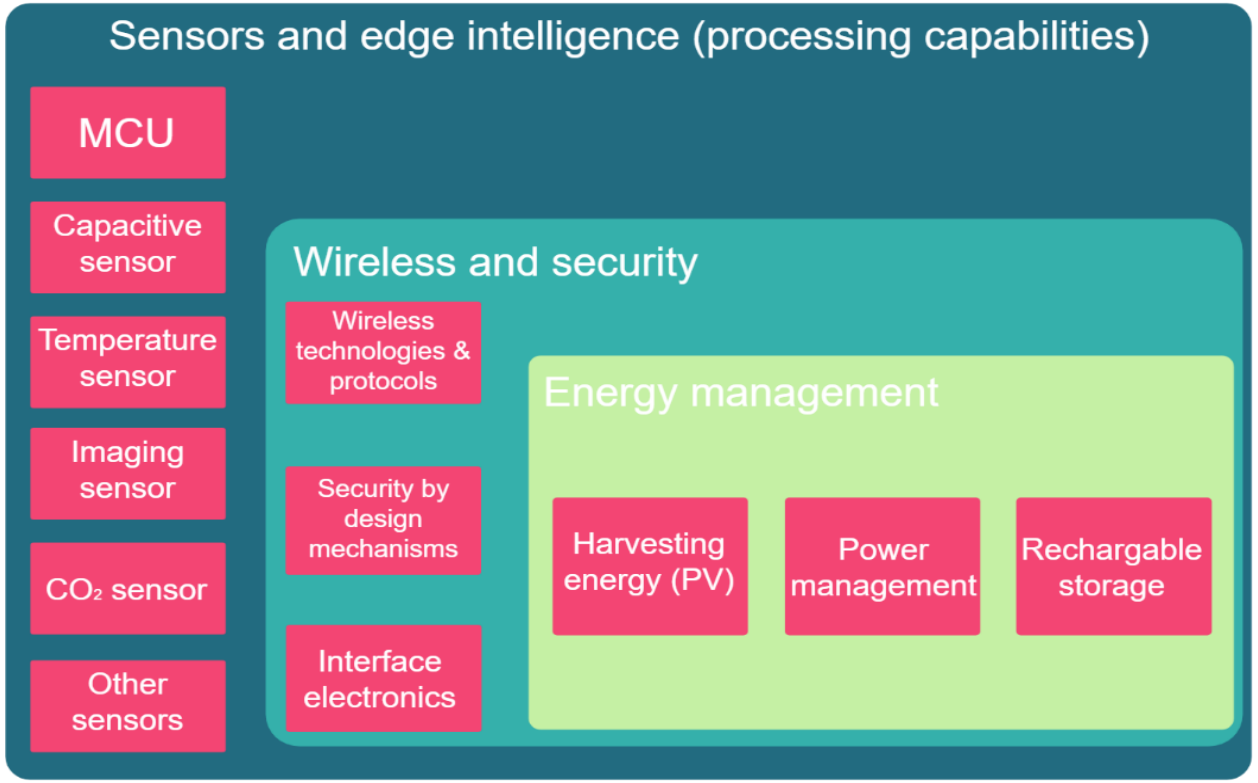
AMANDA conceptual view



Conceptual view of the final AMANDA card – less than 3mm in height

AMANDA architecture

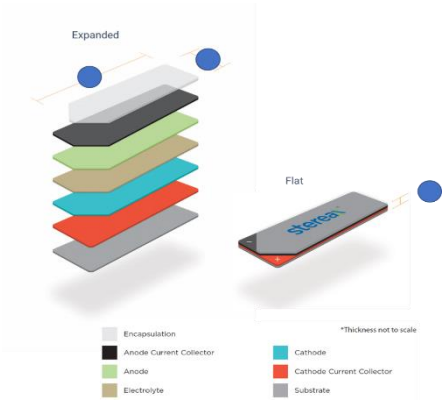


Different hardware architecture layers of AMANDA

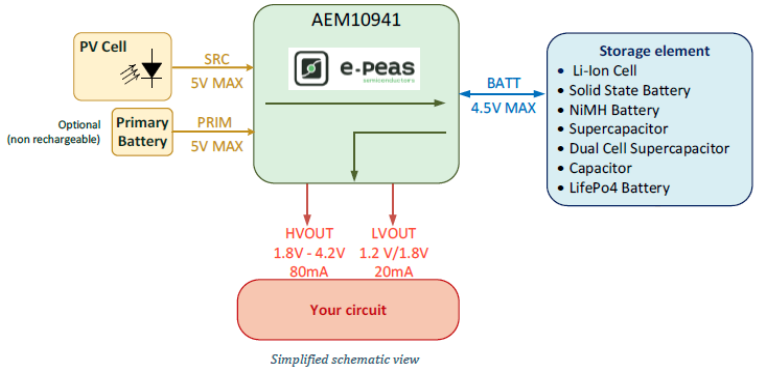
AMANDA main hardware components

- **PV Energy Harvester – Lightricity**
  - Ultra-thin, ultra-efficient with a small footprint

- **Energy storage – Ilika**
  - Miniaturised solid-state lithium-ion battery



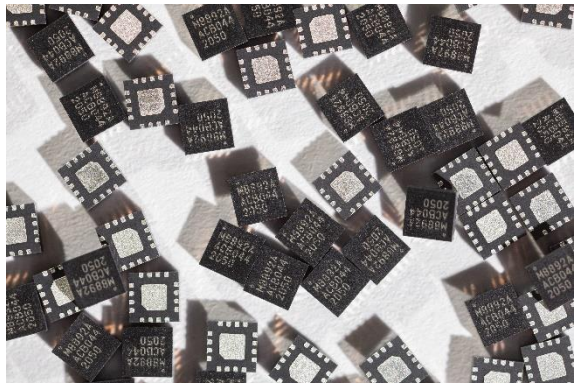
- **Power management integrated circuit (PMIC) – EPEAS**
  - Innovative PMIC with a small system footprint that manages the energy provided by the energy harvester



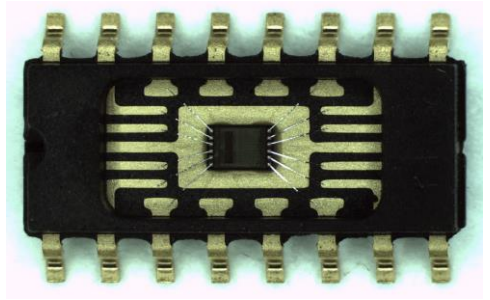
Simplified schematic view

AMANDA main hardware components

- **Touch sensor - Microdul**
  - Lowest active-power capacitive switch, able to measure absolute capacitance

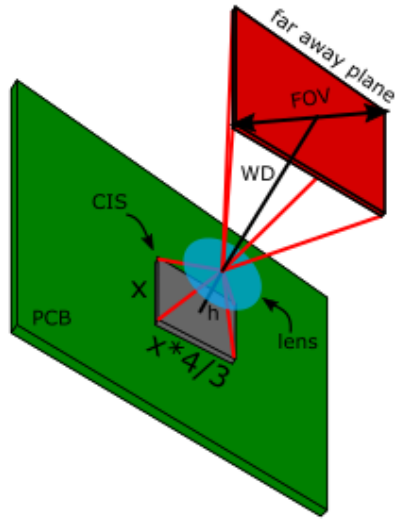


- **Temperature sensor - Microdul**
  - Low-power temperature sensor with minimum dimensions

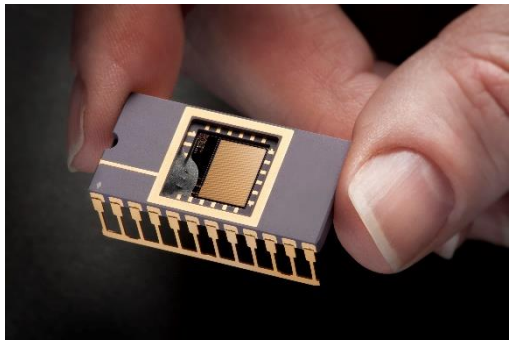


AMANDA main hardware components

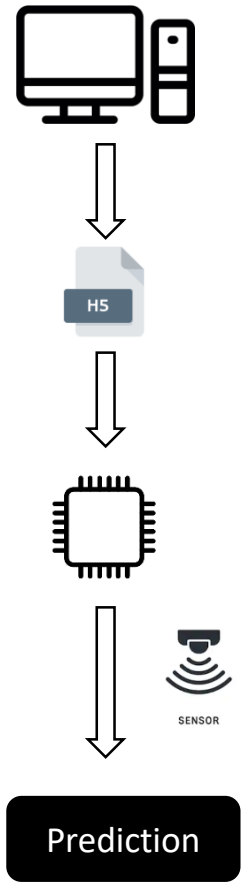
- **Imaging sensor – EPEAS**
  - Fully-integrated QVGA CMOS imager with ultra-low power consumption



- **CO_2 sensor – IMEC**
  - Highly miniaturized state-of-the-art gas sensor for CO_2



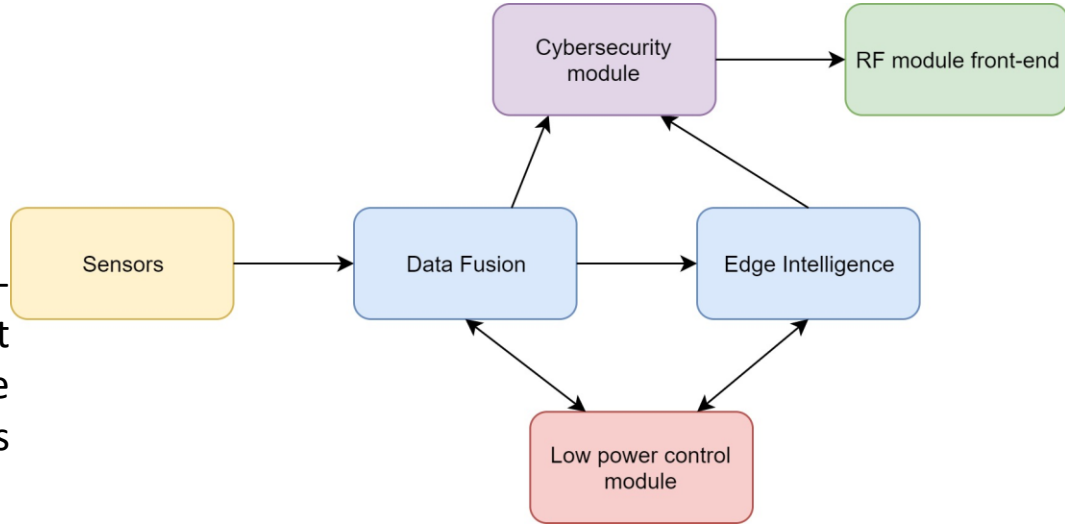
AMANDA modular software development



Data fusion: capitalizing on recent advances for data computing at fog/edge nodes such as collection, cleaning, pruning and indexing

Cybersecurity: focused on low-power implementations that offer hardware and software protection against malicious users or devices

Edge intelligence. Supervised and unsupervised learning methods are used to identify patterns, extract and select features, make predictions and decisions with minimal human involvement



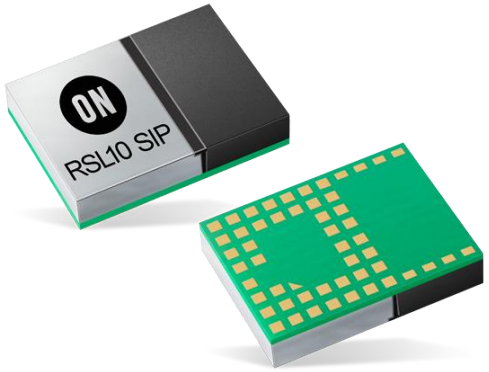
Different architecture layers of AMANDA

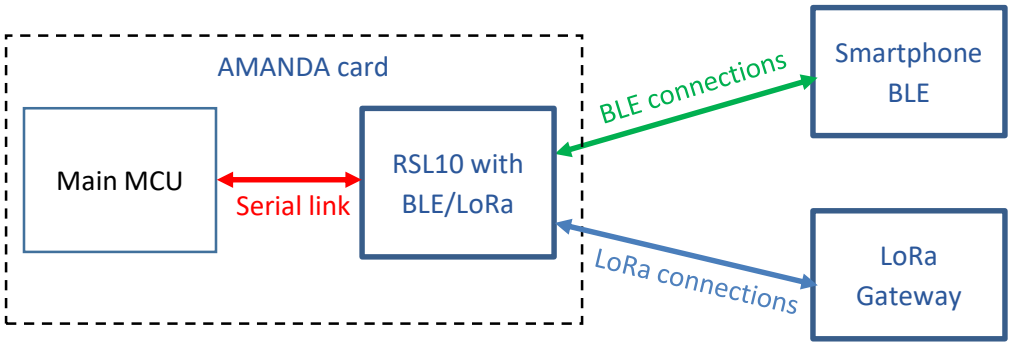
Wireless communication

- Very widespread protocol, available on smartphones, PCs
- Very low power consumption (tens of µJ)

- Reads or writes data from/on passive NFC devices
- Enable wireless charging capabilities

- Widespread in IoT applications
- Several Kms range
- Adaptive data-rate to increase range or decrease energy consumption





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