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EUCNC / 6G Summit

SUPERIOT: Towards a Truly Sustainable Internet of Things: Concepts and Technologies

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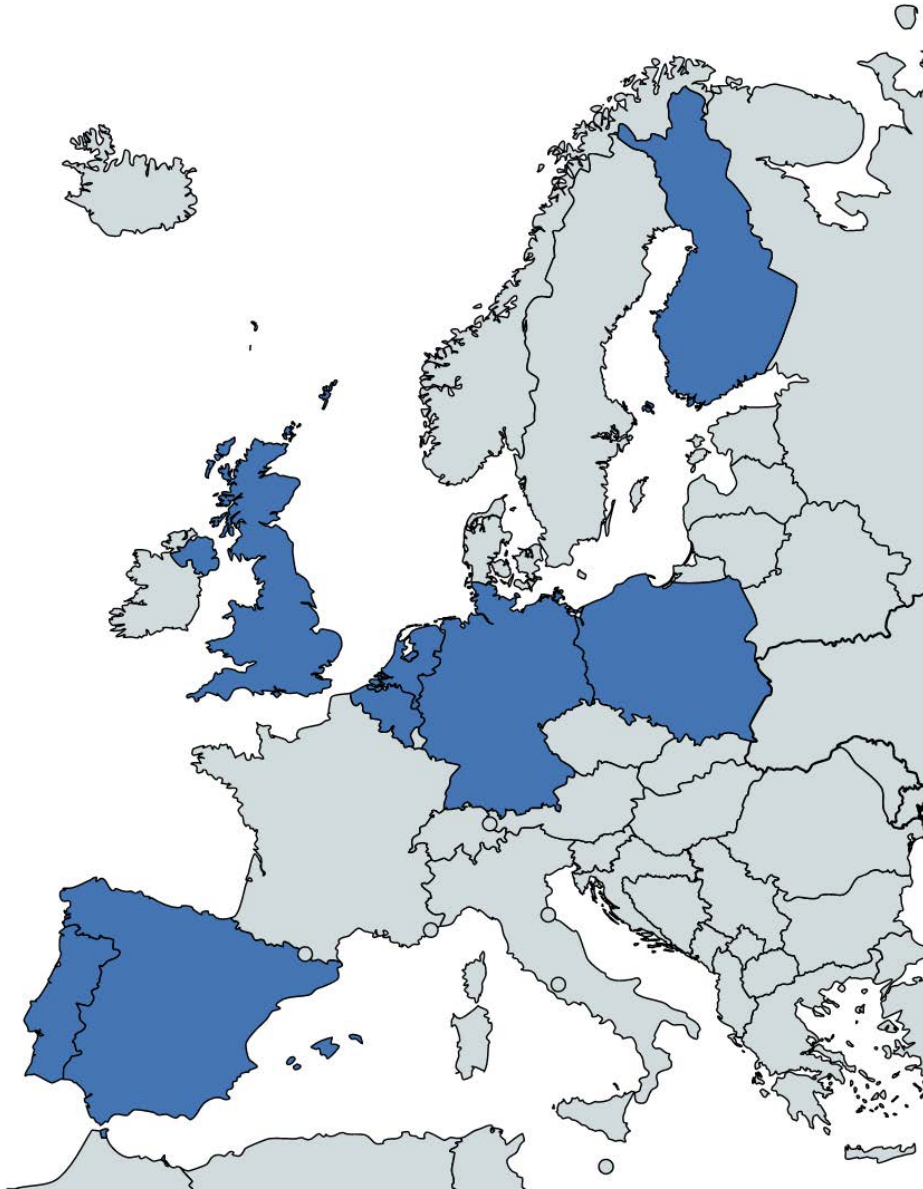
Project Key Information

Project fact sheet

Project number	101096021
Project name	Truly Sustainable Printed Electronics-based IoT Combining Optical and Radio Wireless Technologies
Project acronym	SUPERIOT
Call	HORIZON-JU-SNS-2022
Topic	HORIZON-JU-SNS-2022-STREAM-B-01-03
Type of action	HORIZON-JU-RIA
Project start date	1 January 2023
Duration	36 months
Total EC funding	4 757 739.50 €

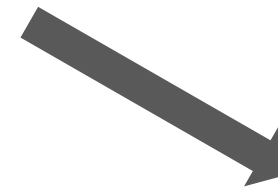
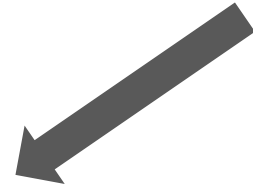
superiot.eu

SUPERIOT Consortium



- **Partnership**
 - 10 partners
 - 1 associated partner
- **Involved nations**
 - Belgium
 - Finland
 - Germany
 - Netherlands
 - Poland
 - Portugal
 - Spain
 - United Kingdom

Wireless Communication Systems

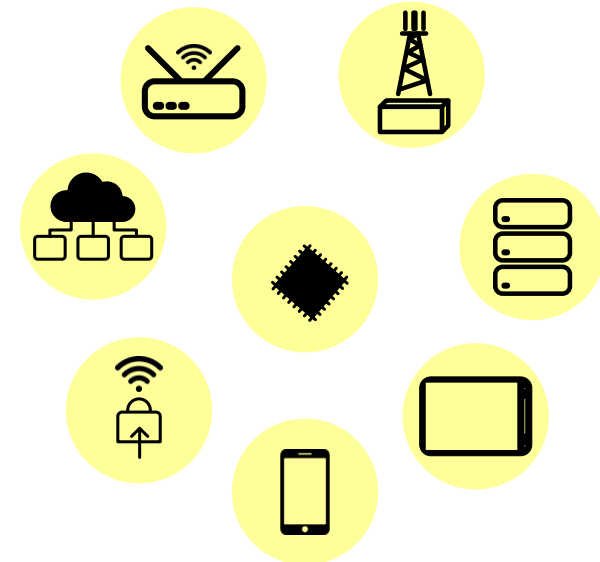


Wireless Communication Systems for Sustainability



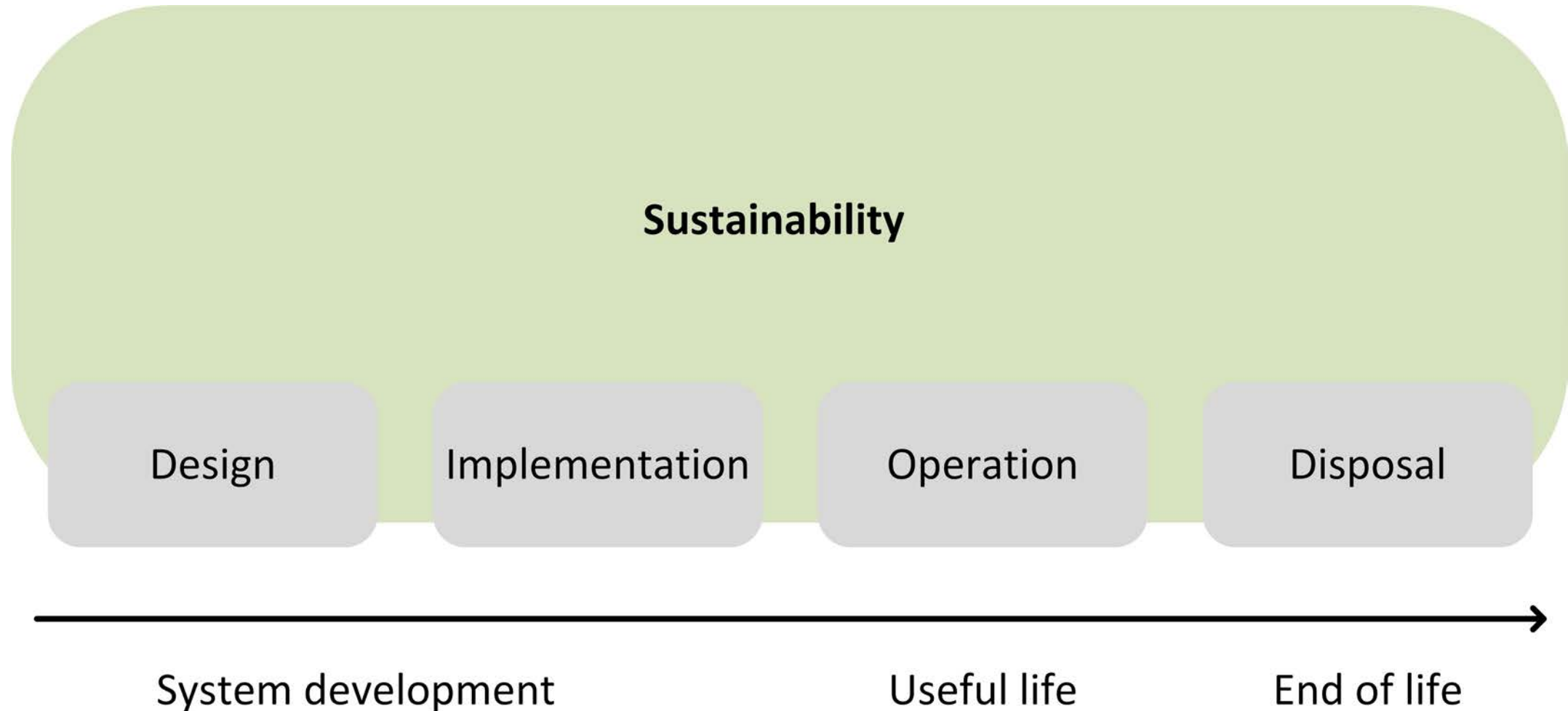
Part of the solution!

Sustainable Wireless Communication Systems



Part of the problem!

A Holistic Approach to Sustainability



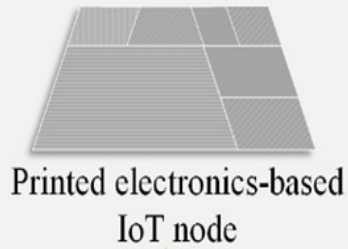
Stages of a wireless communication system

The SUPERIOT Approach

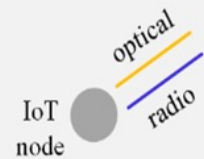


- **SUPERIOT** offers a unique holistic approach to sustainable IoT
 - Sustainable by design
 - Sustainable by implementation
 - Use of printed electronics technology
- **SUPERIOT** combines light and radio technologies
 - to provide wireless connectivity
 - to support energy autonomous operation of nodes/devices
 - to provide reliable and accurate positioning
 - to create a highly flexible and adaptable IoT system
- **SUPERIOT** will develop several demonstrators to validate the created concepts

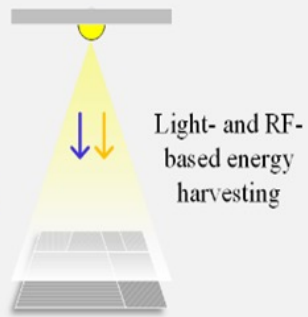
SUPERIOT: Basic Concepts



Sustainable IoT node



Reconfigurable multi-mode node (optical- and radio)



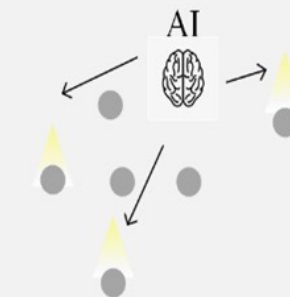
Energy-autonomous IoT node

Multi-mode (radio-optical) IoT Gateway



Reconfigurable highly-secure architecture for optical-radio communications

Sustainable IoT network



Network-level smart energy harvesting and management



Precise positioning based on optical and radio signals

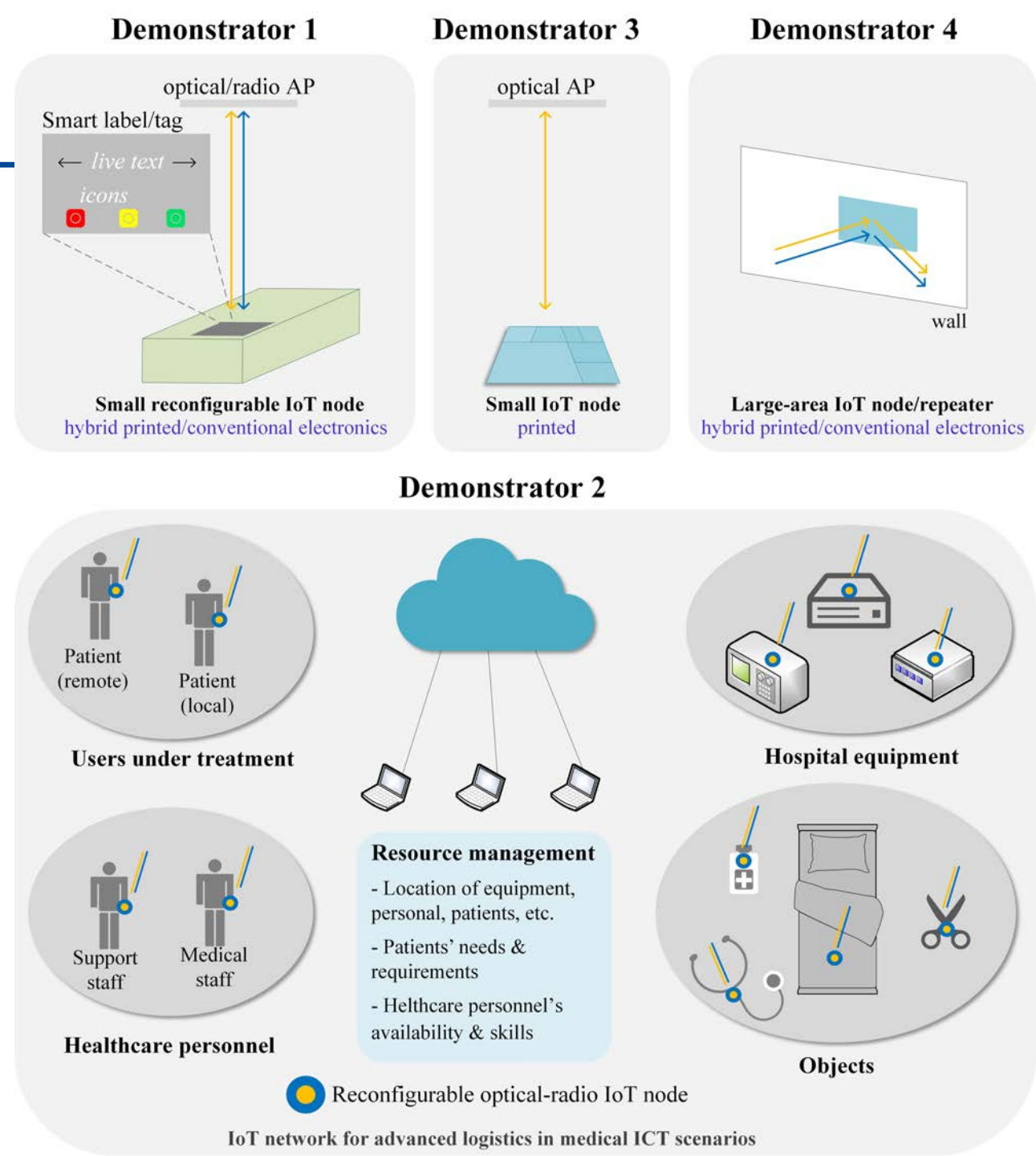
Project Objectives

- Demonstrate that **dual-mode IoT (radio/light-based)** is not only feasible but also results in a highly flexible and adaptable solution.
- Demonstrate **dual mode energy harvesting** as a part of the SUPERIOT concept.
- Demonstrate **dual mode positioning as a part** of the SUPERIOT concept.
- Demonstrate that **printed electronics** is a key technology to implement sustainable IoT nodes.
- Develop, demonstrate and advocate the concept of **Truly Sustainable IoT**.
- Create and support concepts for the future based on the approaches developed in SUPERIOT.

Project Demonstrators

Four Project Demonstrators

- 1) Small reconfigurable IoT node (Hybrid technology)
- 2) Advanced IoT network for medical ICT scenarios
- 3) Small limited-capability IoT node (printed technology)
- 4) Large-area IoT node

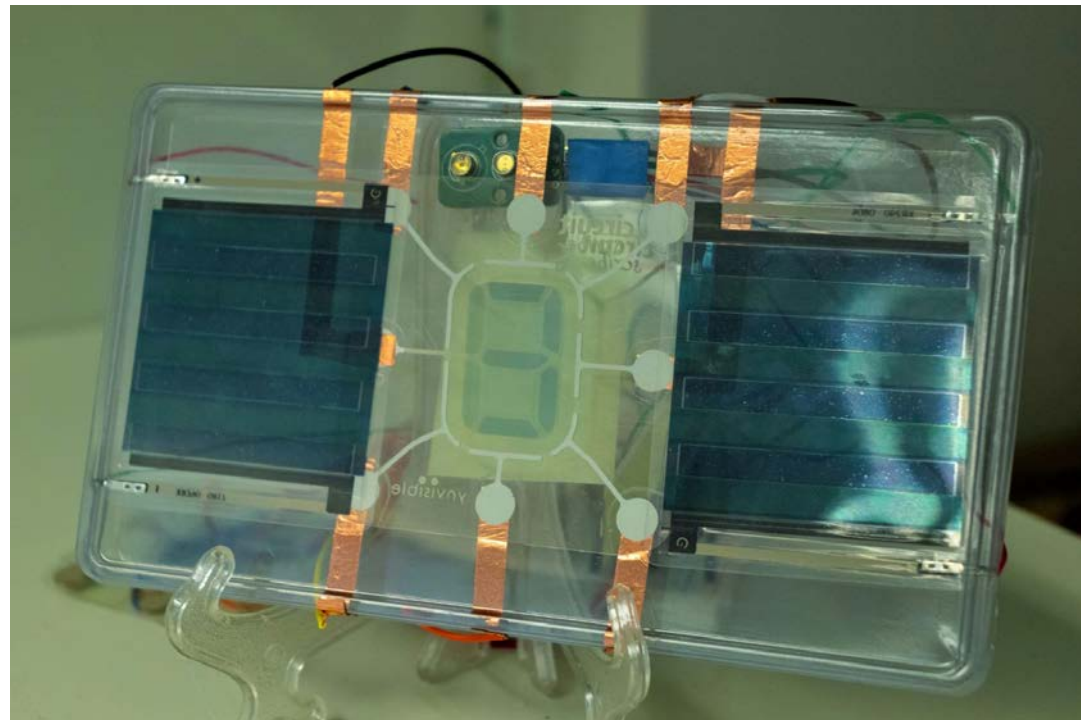


Existing Experimental Test-beds

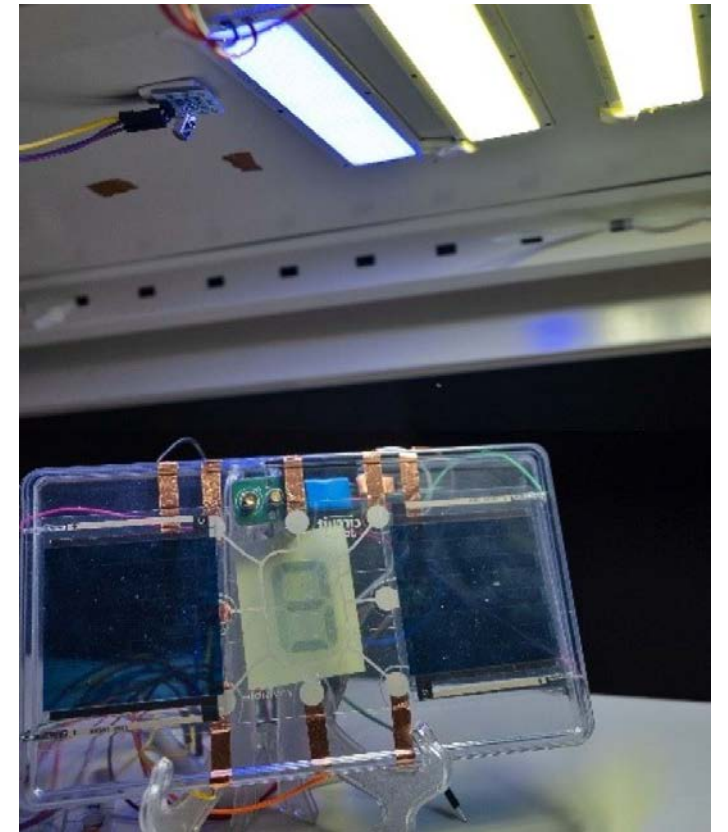
Light-based IoT (LIoT) system at CWC, University of Oulu

- Energy autonomous LIoT node (batteryfree)
- Visible light used in downlink, IR light used in uplink
- Printed electronics used in the implementation (e.g., PV cells, displays, etc.)

Energy autonomous light-based IoT node



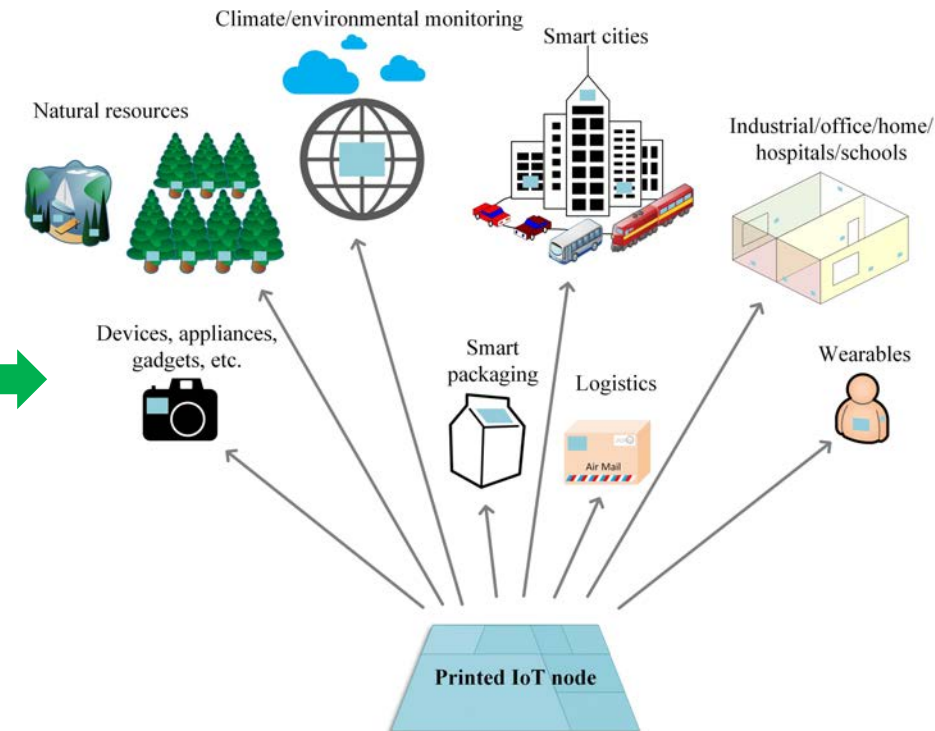
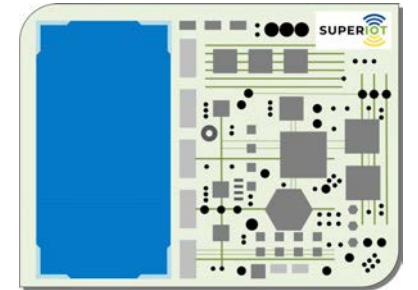
Light-based IoT node
and optical access point



Project Visions

- SUPERIOT will develop a future-proof concept, paving the way towards novel technologies. In the next decade, we might see:
- **Fully-printed reconfigurable optical-radio IoT nodes** →
- **Extremely inexpensive nodes** (e.g., one-cent node)
- **Environmentally-friendly disposable IoT nodes:** use of biodegradable electronics, etc.
- **Novel scenarios/use cases:**
 - **Massive sensing & massive actuation** →
 - Inside the human body
 - Underwater
 - Mining
 - Etc.

Sticker-like printed IoT node



Current Development

Three main scenarios for the project were identified:

- **Smart tags and labels**
- **Massive sensing and actuation**
- **Enhanced IoT communications**

- Each scenario has several applications, each with its own requirements.

- The final applications to be demonstrated in the project will be selected later this year.

- **Node development:** Node architecture under development.

- Key technologies for dual-mode communication systems and energy harvesting systems.
- Printed component library.
- Hybrid node implementation partition.

- **Architecture development:** System architecture including access points, gateways and other key components under development.

- Protocols.
- Energy management.
- Dual-mode positioning.
- Etc.

- The **SUPERIOT** concept exploits radio and light technology to create a sustainable IoT system
 - Dual-mode communications
 - Dual-mode energy harvesting
 - Dual-mode positioning
 - Printed electronics technology to be used as much as possible for the implementation of the reconfigurable IoT nodes.
- Four proof-of-concept demonstrators to be developed and presented at the end of the project.
- SUPERIOT aims at serving as an motivating example paving the way towards **truly sustainable communication systems**.

THANK YOU

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