Alliance for IoT and Edge Computing Innovation

AIOTI DAYS 2024

24-25 Sep

BRUSSELS

Session: Use cases applying methodologies for CO2 reduction measurements

Estimating CO2 Emissions in Optical Access Networks for Industrial Vision Inspection Use-case

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Acknowledgment: Massimiliano Sica, Dr. Johannes Fischer, Prof. Dr. Ronald Freund

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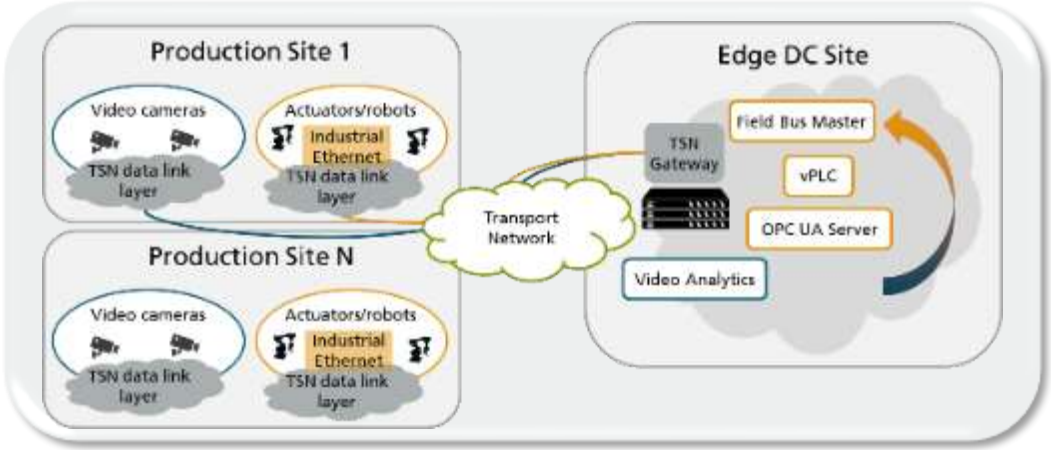
HUAWEI

DUNAV NET

Industrial Vision Inspection Use-case

INDUSTRIAL TEST FIELD

Cloud-based Vision Inspection



Factory Scenario

- Large manufacturing sites
- Requirement for >1000 fixed access points
- How to reduce power consumption and CO2 emissions?

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CO2 Estimation Methodology

- ITU-T proposed metric for CO2 estimation:
  - **Network Carbon Intensity energy** (units $\frac{kgCO2e}{TB}$)

$$NCIe = \frac{Total\ network\ energy\ consumption\ \times EF}{Total\ data\ traffic}$$

where Emission Factor (EF) is the mass of carbon emitted per unit of energy (units $\frac{kgCO2e}{kWh}$)

ITU-T L.1333 (09/2022)

TELECOMMUNICATION STANDARDIZATION SECTOR OF ITU

Carbon data intensity for network energy performance monitoring

- For domestic electricity in Germany [1]:
  - **Year 2021:** $EF = 0.435$
  - **Year 2028 (target):** $EF = 0.107$

[1] Bundesamt für Wirtschaft und Ausfuhrkontrolle, "Informationsblatt CO2-Faktoren" https://www.bafa.de/SharedDocs/Downloads/DE/Energie/eew_infoblatt_co2_faktoren_2023.pdf?__blob=publicationFile&v=3

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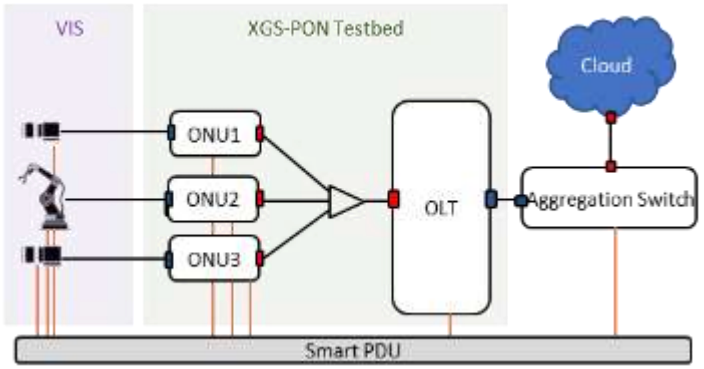
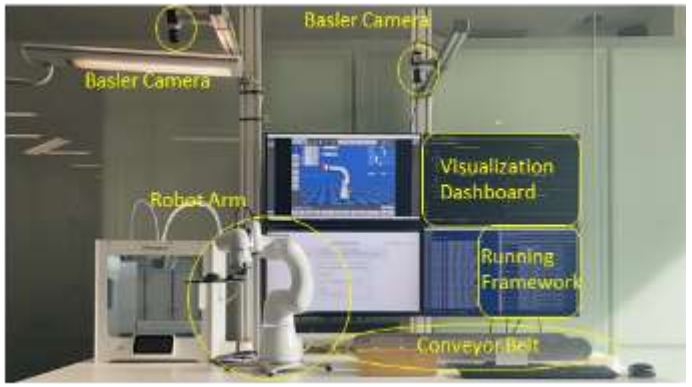
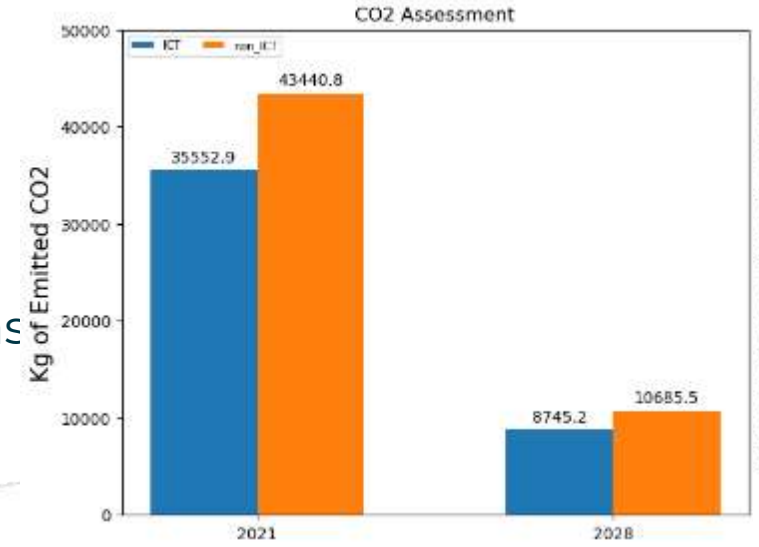
Testbed and CO2 Estimation Results

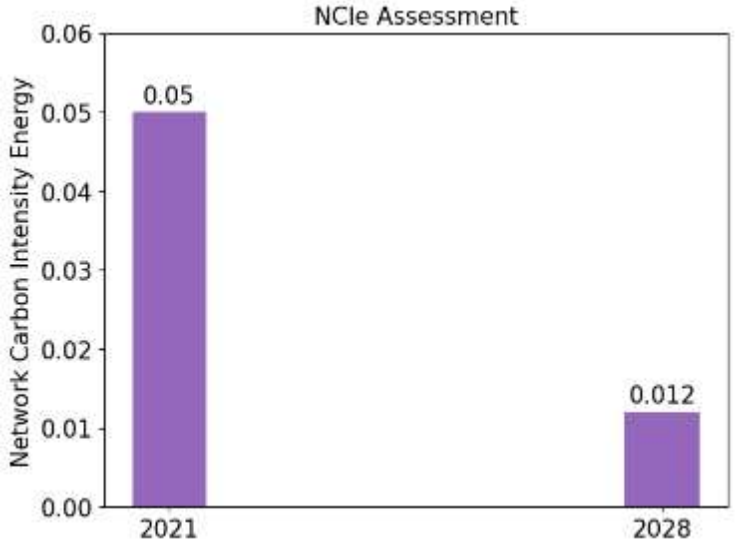
- XGS Passive Optical Network (XGS-PON) testbed, powered by smart Power Distribution Unit (PDU)
  - **ICT devices:** Optical Network Units (ONUs), Optical Line Terminal (OLT)
  - **Non-ICT devices:** cameras, robotic arm, conveyor belt
- CO2 analysis done for scaled-up version of the testbed:
  - 200 VISs, 600 ONUs, 400 cameras, 200 robotic arms, 200 conveyor belts
- **Next steps:** enable quantification of net benefits (incl. 1st and 2nd order effects as in ITU-T L.1480)





Testbed at Fraunhofer HHI





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Thank you!

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