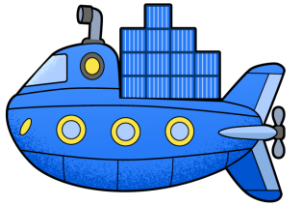

NEMO

NExt Generation Meta Operating System

ENABLING SMART FUTURES: NEMO'S IMPACT ON ENERGY, MOBILITY, AND INDUSTRY 4.0

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Trial #3: Smart Energy & Smart Mobility/City Use Cases & Living Lab

MOTIVATION

- Validate NEMO **ability to monitor and stabilize** the electricity smart grid
- **Improve** Renewable Energy Sources (RES) **load balancing** via EV chargers
- **Traffic flow/parking prediction** via EV chargers for Mobility
- **Supporting citizens' eco-mobility** in a smart city scenario combining crowd-sourced information and public transport, weather/noise data together with historical data and CCTV/traffic analysis

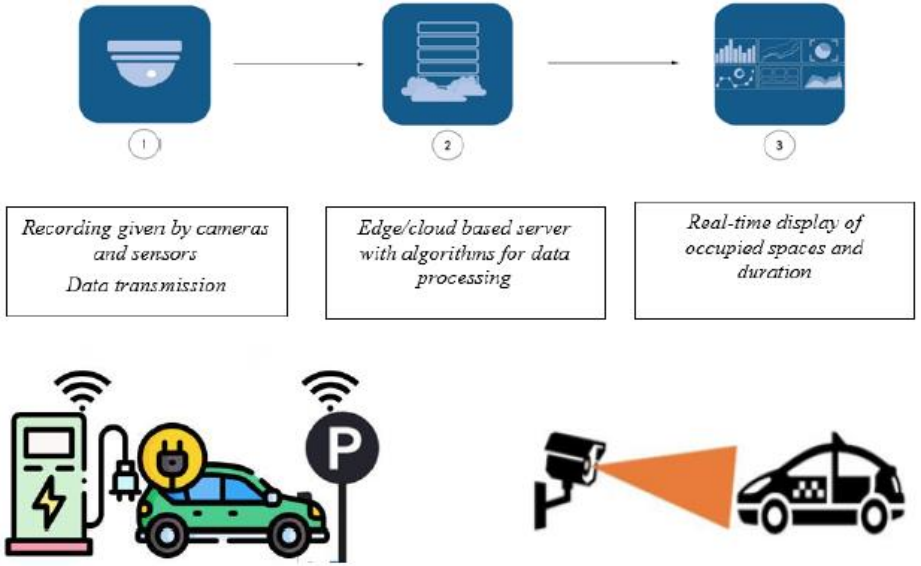


Figure 24: Smart Mobility/City parking sensors

Trial #3: Smart Energy & Smart Mobility/City Use Cases & Living Lab

USE CASE APPLICATIONS

1. **Smart Grid Flexibility:** stabilize the grid with high-tech sensors to monitor voltage quality and balance energy flow between renewables, buildings, and offices.

2. **Smart Mobility/City:** optimize EV charging and traffic flow prediction, using real-time and historical data to support seamless, driver-friendly urban mobility.

In both cases, advanced AI-based analytics will be investigated to train models at different levels **at the same time**:

- At AIoT level, for identifying potential local energy grid discrepancies using already trained ML models
- At Edge cloud, for applications such as protection, power quality and partial discharge detection
- At Cloud level to elaboration of streams or pre-elaborated data coming from different locations

Trial #3: Smart Energy & Smart Mobility/City Use Cases & Living Lab

SMART ENERGY AND SMART MOBILITY LIVING LAB

- **Smart Energy & Mobility Lab:** Located in Terni (Umbria, Italy), operated by ASM, EMOT, and TSG, focused on integrating smart energy and mobility solutions
- **Infrastructure:** Includes 4 Medium/Low Voltage substations, a 200 kW photovoltaic plant (often with surplus from renewable energy), and 65 smart EV chargers
- **Fleet & Charging:** Six leased Renault Zoe EVs with additional smart chargers (one 52 kW fast charger and two 22 kW chargers)
- **Technology & Network:** Utilizes WIND 5G, TSN by CMC, and twin Green Data Centers (ASM in Italy, RWTH in Germany) to manage energy and CO2-based KPIs for sustainable microservices

Figure 26: Smart Mobility/City charging station

Trial #3: Smart Energy & Smart Mobility/City Use Cases & Living Lab

KEY PERFORMANCE INDICATORS

- Time granularity for monitoring < 1 sec and interaction capability > 100.000 measurements/minute
- Reduce the probability of Smart Grid failure due to voltage instability > 25%
- Migrate micro-services between ASM and Green RWTH DC and reduce CO2 footprint > 40%
- Increase urban EV charging efficiency > 20%

Trial #4: Smart Manufacturing & Industry 4.0 Use Cases & Living Lab

MOTIVATION

- **Improve mass production and safety in factories** with high levels of automation, enabling Collaborative Robot (Cobots) systems, Automated Guided Vehicles (AGVs) and human's co-work
- **High speed heterogeneous connectivity** using 5G NR, TSN and Wi-Fi ad various types of AGVs
- **Analyze** input from sensors, 3D cameras and RFID nodes, **predict**, **identify and avoid** collisions between humans and AGVs and between different types of AGVs

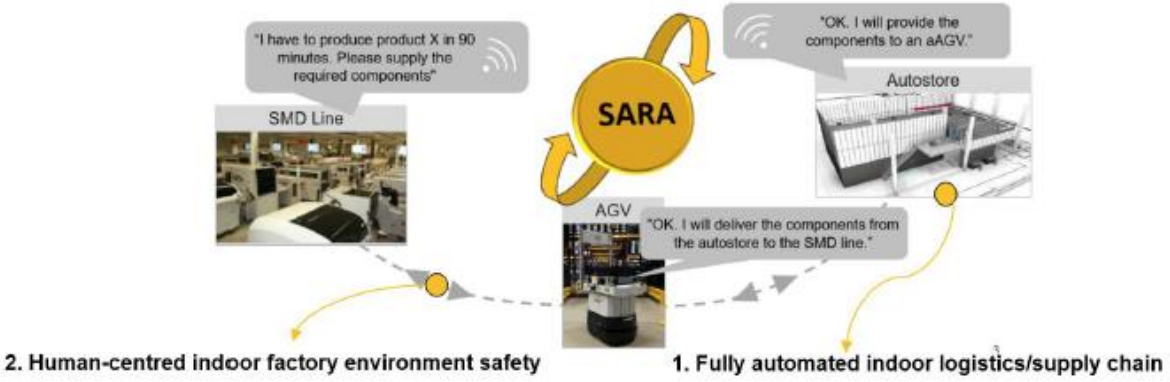


Figure 32: Abstract visualisation of material supply in Continental plant Ingolstadt

Trial #4: Smart Manufacturing & Industry 4.0 Use Cases & Living Lab

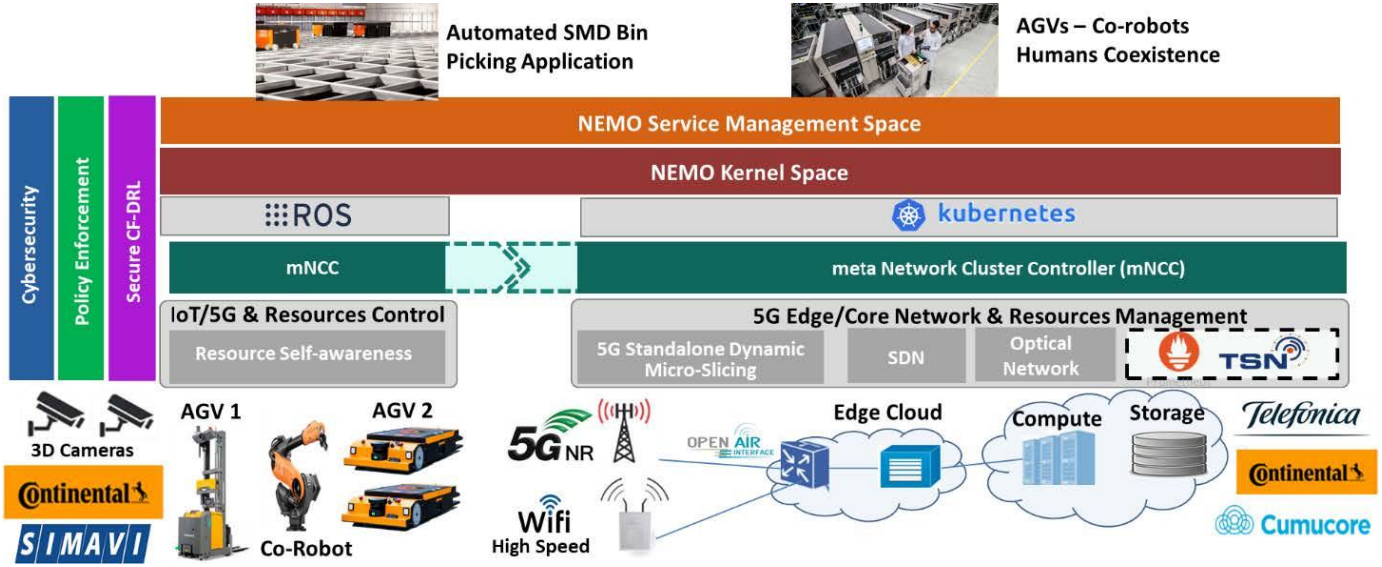
USE CASE APPLICATIONS

1. **Fully automated indoor logistics/supply chain**: Targeting ADAS manufacturing, this use case fully automates material handling with 3D vision, barcode scanning, cobot, and AGV collaboration to transfer materials autonomously from storage to production.

2. **Human-centered indoor factory environment safety:** Real-time AGV localization and cognitive sensors (cameras, radar, lidar) create a "safety shell" for workers. A high-speed network supports AI-driven collision avoidance, enhancing human safety in factory environments.

Trial #4: Smart Manufacturing & Industry 4.0 Use Cases & Living Lab

INDUSTRY 4.0 AND SMART INDOOR LOGISTICS/SUPPLY CHAIN LIVING LAB



Trial #4: Smart Manufacturing & Industry 4.0 Use Cases & Living Lab

INDUSTRY 4.0 AND SMART INDOOR LOGISTICS/SUPPLY CHAIN LIVING LAB

Table 13: The equipment used in the Smart Manufacturing & Industry 4.0 trial.

Equipment	Description / Specifications	Type	Status
SARA	Standard Automated Replenishment Application	Edge/Cloud	available
AutoStore	Warehouse-System	Edge/Cloud	available
ASBS	Automated Sorting and Booking Station	Edge/Cloud	available
conveyor system	to transport parts	Edge	available
scan gate	to register the parts	Edge	available
Robot (TM / UR)	to sort and put away the parts	Edge	available
box station	for automatic supply of boxes	IoT/Edge	available
NAiSE	Order manager	IoT/Edge	available
aAGVs / Fleetmanagement	To transport material to production line	IoT/Edge	available
Servus	Floor jump material transport	IoT/Edge	In procurement

Trial #4: Smart Manufacturing & Industry 4.0 Use Cases & Living Lab

KEY PERFORMANCE INDICATORS

- Different types of AVG and cobots to be addressed >4
- Different types of sensors' data (camera, 3D camera/lidar, radar, Ultrasonic) to be analysed >10
- System reaction in emergency cases < 0.5 sec
- Improve AGV-Human collision avoidance and improve manufacturing safety at least 30%
- ADAS supply chain improvement (improved accuracy >30%, cost and time reduction > 20%)

NEMO Partners

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Thank you ☺