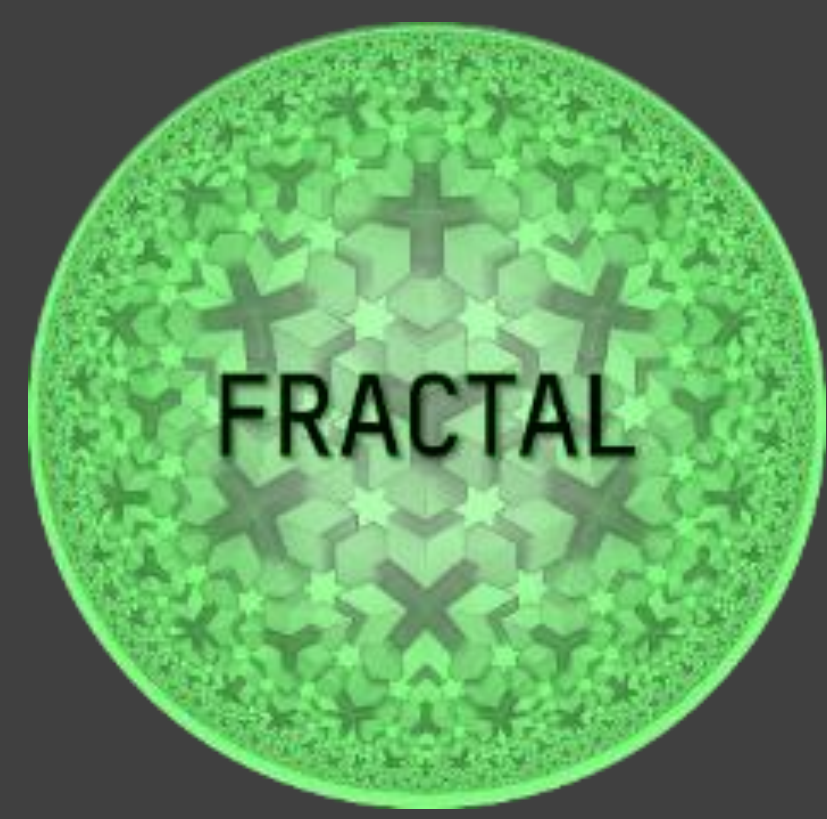


UC8 Autonomous warehouse shuttles

UC Leader: BEEWEN Automation



UC description

The approach of this use case is the implementation of a fractal concept in a shuttle system as an automated storage and retrieval solution to increase adaptability and reliability and thus improve the most important aspect. The increase of throughput with technological/ physical limited resources due to energy, limited computing power and limited build size. In the demonstration, a test setup will be provided with typical industrial considerations in regard of standards for functional safety and common practices.

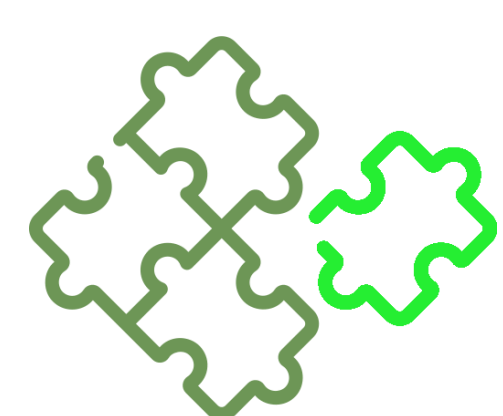
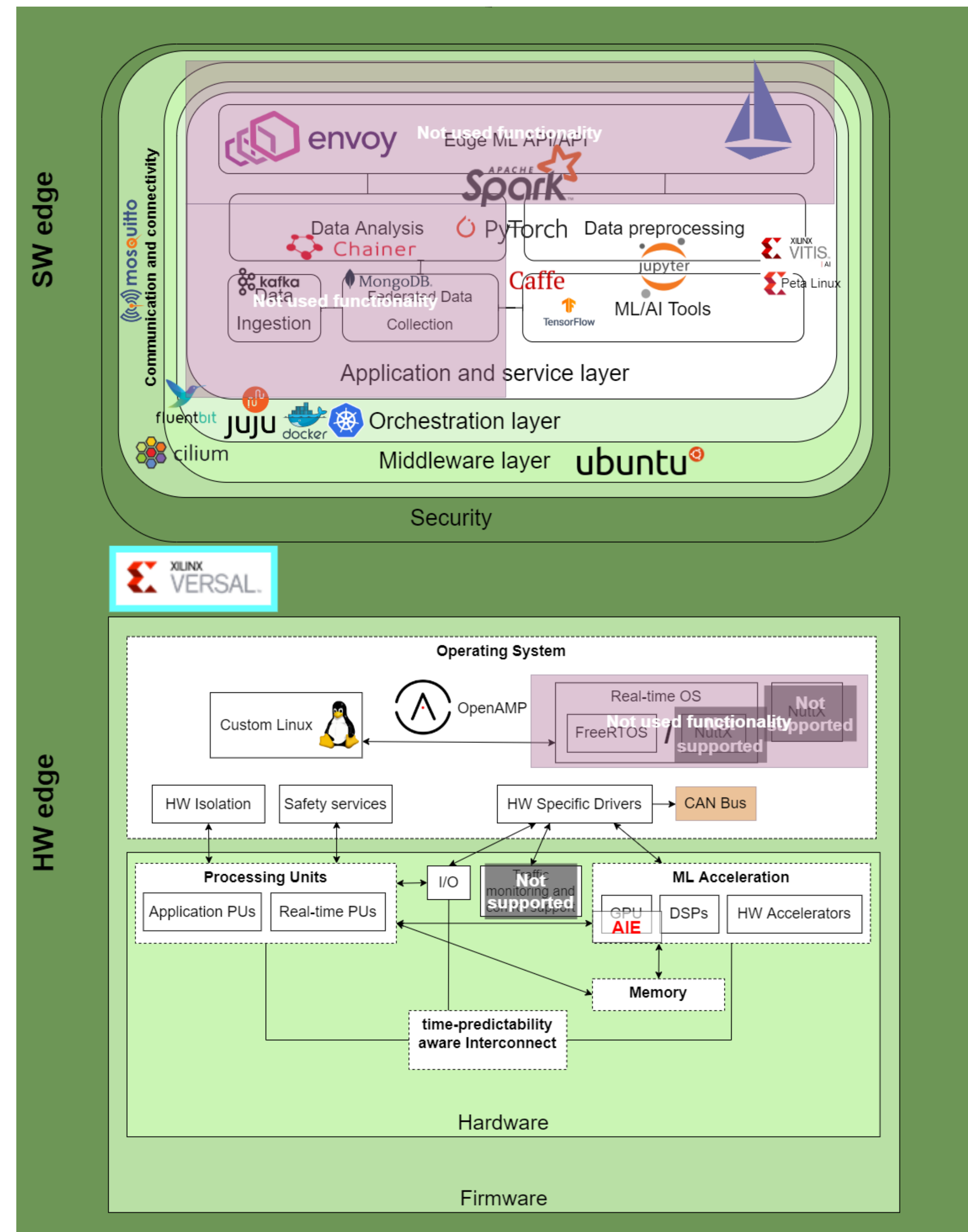
The following capabilities are added to the proposed system:

- ❖ Autonomous behavior for each shuttle in terms to functional safety
- ❖ Adaptive orchestration of the jobs and the pathfinding

UC8 consists of:

- ❖ FRACTAL edge nodes in lifts/ elevators and shuttles
- ❖ FRACTAL edge node in each shuttle utilize cameras for object detection,
- ❖ different sensors for positioning and localization,
- ❖ wireless communication to other FRACTAL edge nodes
- ❖ FRACTAL edge node in the lift/ elevator utilize an AI accelerated orchestrator/ scheduler for planning warehouse optimization and path planning tasks,
- ❖ different sensors for positioning and operation monitoring

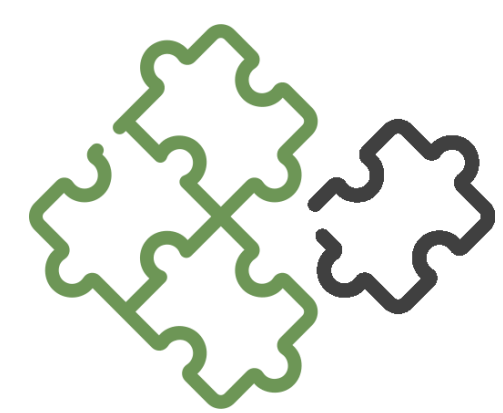
This architecture is intended to apply the fractal approach in a shuttle system to form a swarm.



FRACTAL Components

The FRACTAL platform for Versal provides important core components, which are necessary for UC8:

- ❖ WP6T61-01-03 Petalinux
- ❖ WP6T61-01-04 Vitis AI
- ❖ WP6T61-02-02 Mosquitto
- ❖ WP6T61-03-02 TensorFlow
- ❖ WP6T61-03-05 PyTorch
- ❖ WP6T61-03-06 OpenCV
- ❖ WP6T61-04-01 JSON
- ❖ WP6T61-13 Keras
- ❖ WP6T61-15 Standard C++ Library
- ❖ WP4T42-02 Versal RPU access to AI acceleration
- ❖ WP3T34-03 Versal Model deployment layer
- ❖ WP4T43-04 ATTNoc
- ❖ WP4T43-08 Seamless redundancy for ATTNoc
- ❖ WP4T43-11 Time-Triggered Extension Layer for VERSAL NoC
- ❖ WP4T42-03 Scenario Generator
- ❖ WP4T42-04 GA Scheduler
- ❖ WP4T42-05 AI-Scheduler Model
- ❖ WP4T42-06 Scheduler Verifier
- ❖ WP4T42-07 Hierarchical Metascheduler



UC Components

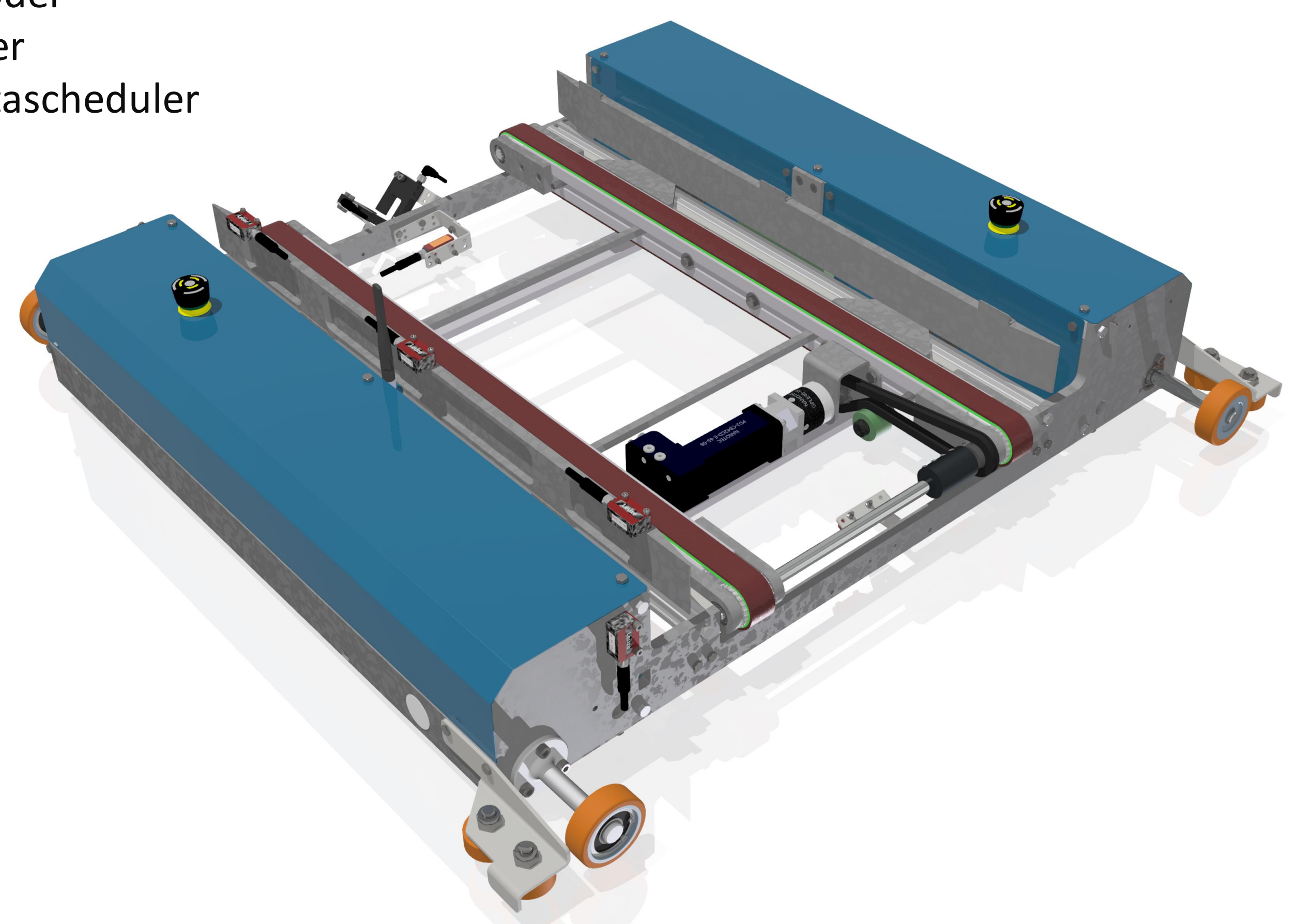
Specific components for UC8:

- ❖ CAN Bus communication for internal components
- ❖ Evaluation of the implemented object detection
- ❖ AI accelerated orchestrator/ scheduler for warehouse optimization and pathfinding



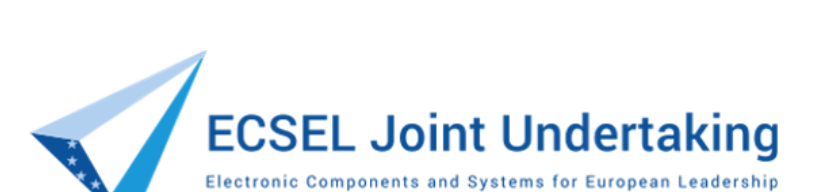
KPIs

- ❖ Requirements from safety concept based on Safety Regulation ISO 61508 satisfied
- ❖ Reaction time of re-scheduling a task of the orchestrator/ scheduler
- ❖ Accuracy of the object detection
- ❖ Reaction time of the
- ❖ Safe wireless communication between edge nodes



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