



The Cluster Conference 2023, Södertälje Science Park, May 9-10

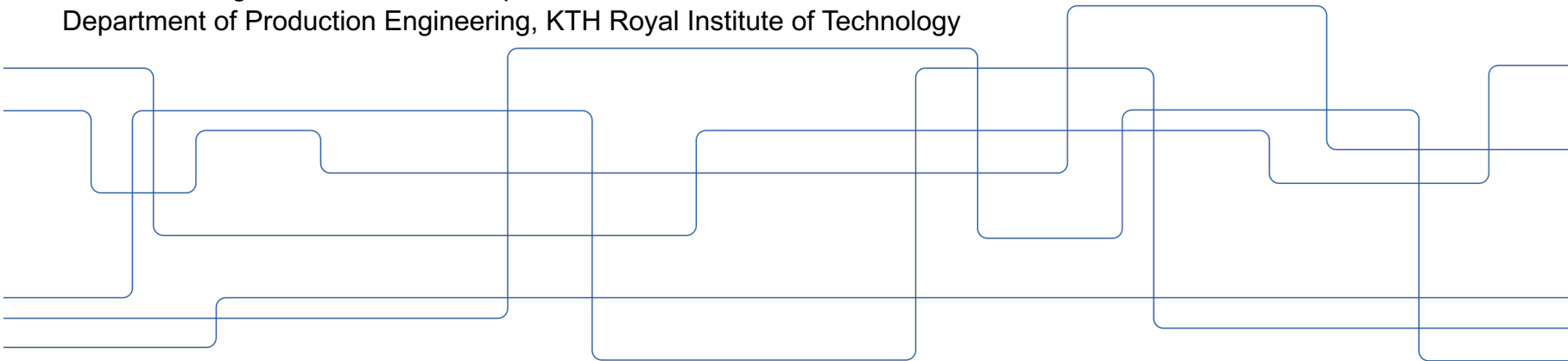
Smart Production Logistics from Data to Service

several cases in production logistics

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Production Logistics Research Group

Department of Production Engineering, KTH Royal Institute of Technology





Industry 4.0

CPS Digital twin

IoT

Digitalization

Smart
Production
Logistics

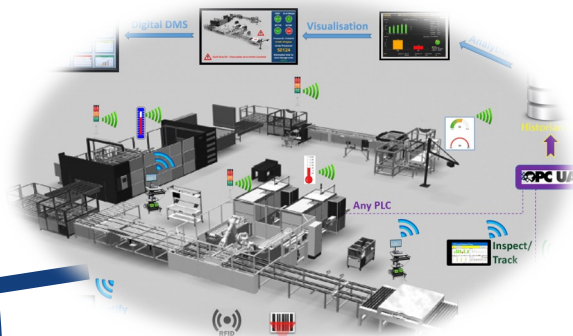


Industry 4.0

CPS Digital twin

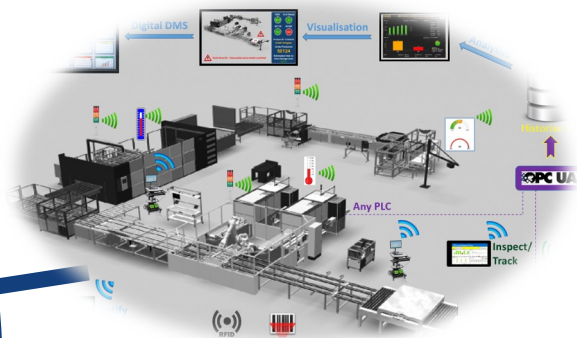
IoT

Smart
Production
Logistics

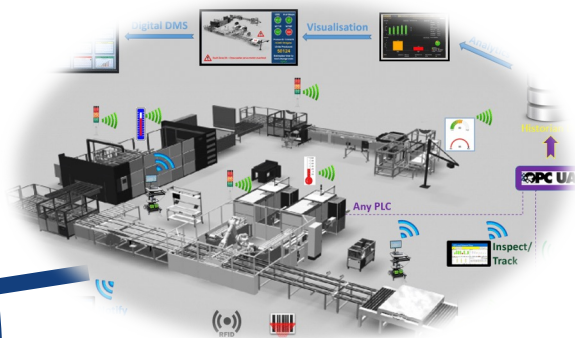




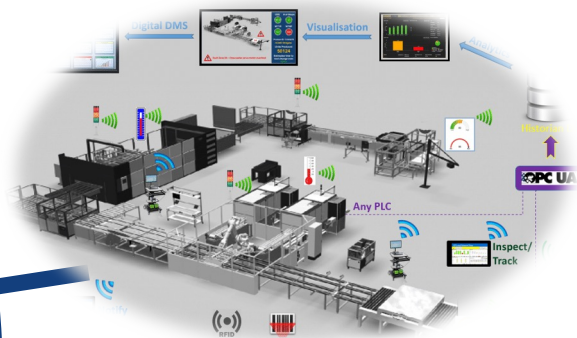
Digital services



Digital services Interface/protocol

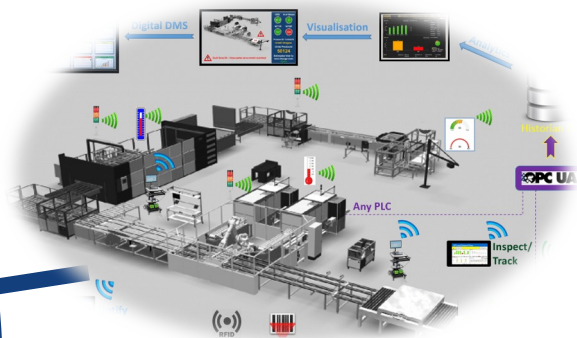


Digital services Interface/protocol Middleware



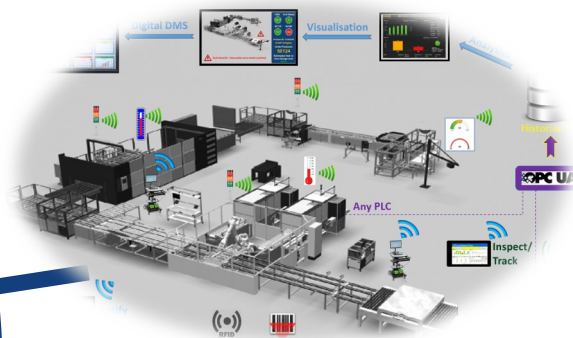
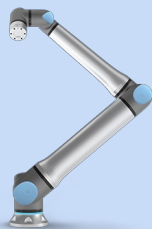


Database/Connection
Middleware
Interface/protocol
Digital services



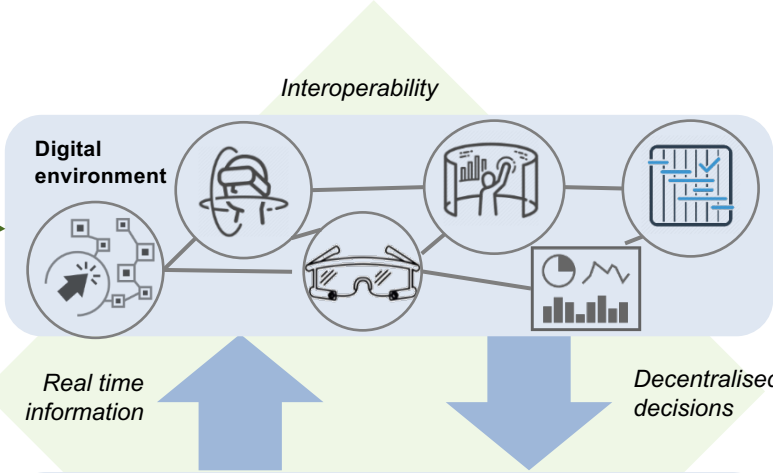


Database/Connection
Middleware
Interface/protocol
Digital services



The team on Production Logistics focus digitalisation for sustainability

Set of services:
From visionary simulation to real time operative monitoring

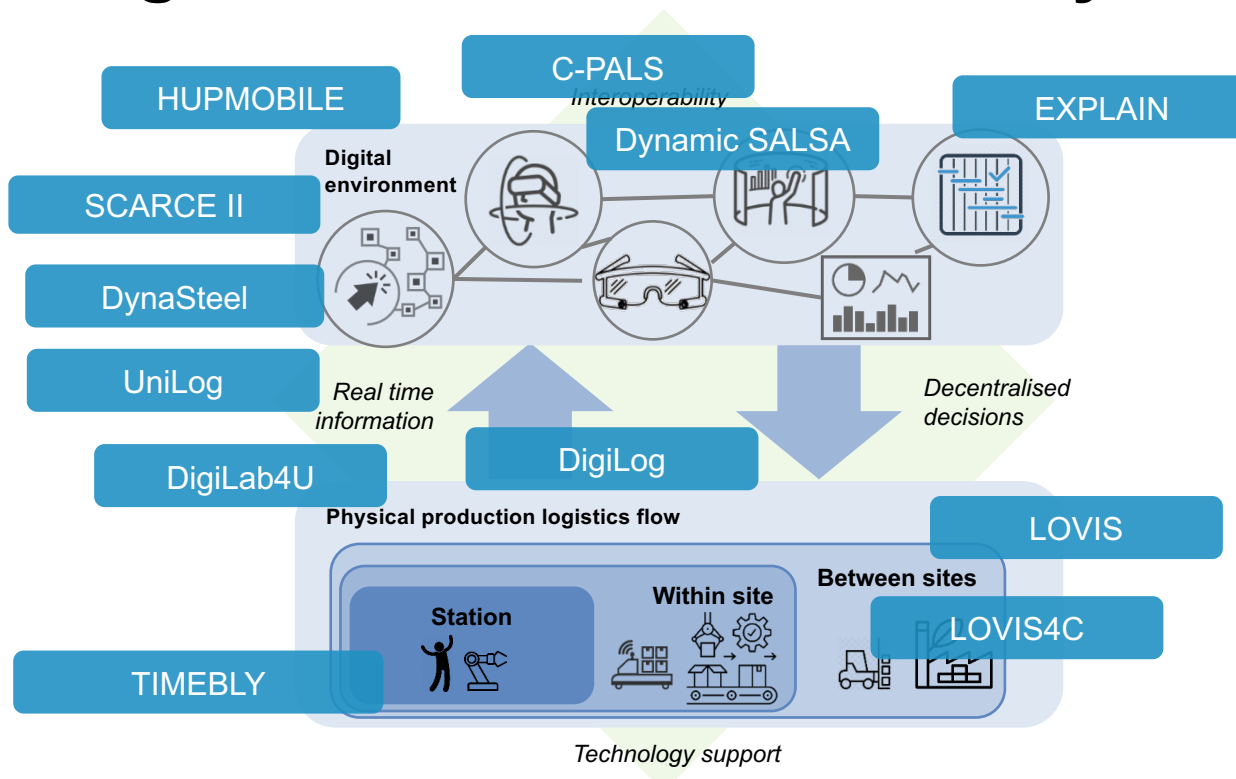


Connected technologies (IIoT)
RTLS, sensors, robots, AGVs, etc

Creating business value in terms of:

- Increased efficiency, resilience and sustainability
- Enables new sustainable production systems

The team on Production Logistics focus digitalisation for sustainability



<https://www.kth.se/ipu/research/ongoing-projects>



Externally funded projects with Production Logistics staff involved

C-PALS (lead)

- Intrasite material supply.
- Modelling and optimization for adaptive scheduling and planning



LOVIS (lead)

- Production Logistic Visibility
- Intra- and inter-site material supply.
- Framework and dashboard solutions



SCARCE II (part)

- Digital tools for supplier – OEM interaction
- Disruption avoidance and performance improvement



DigiLab4U (part)

- Independent networking of laboratory infrastructures
- Connecting online (remote, virtual, hybrid, augmented) lab education



TIMEBLY (part)

- Data collection and time management of manual operations
- Materials handling and assembly



EXPLAIN (part)

- Explainable and Learning production & logistics by Artificial Intelligence



HUPMOBILE (part)

- Optimization and management of mobility of people and goods in freight and cargo logistics.



RESPIRE (part)

- Rethinking the management of unexpected events for resilient and sustainable production





Externally funded projects with Production Logistics staff involved

DYNASTEEL (lead)

- Digital technologies and data analysis to increase visibility and enable dynamic scheduling of internal transport in steel mills



SSAB



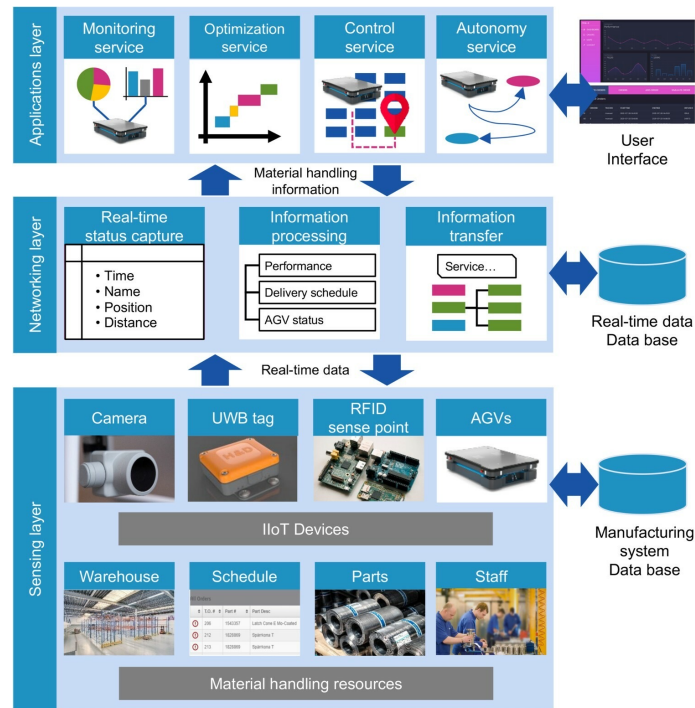
DYNAMIC SALSA (lead)

- Dynamic scheduling technologies
- Smart assembly and logistics for the automotive sector
- Vision systems and digital twins



IloT-enabled digital servitization in SPL

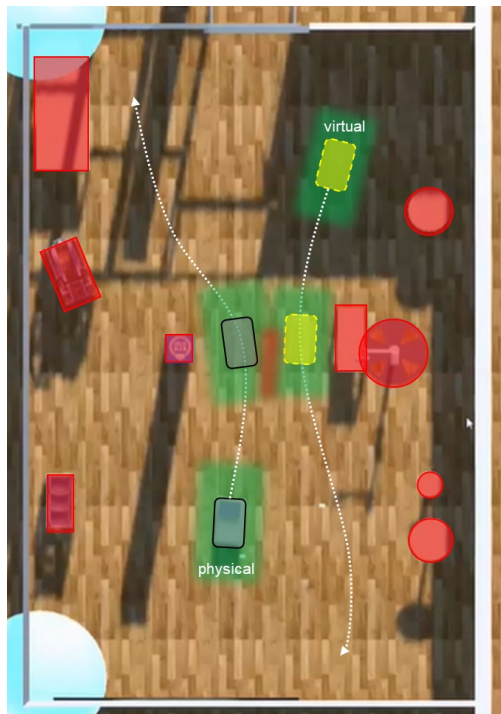
- User interface for digital services
- Application layer
 - Monitoring service
 - Optimization service
 - Control service
 - Autonomy service
- Networking layer
 - Real-time data
 - Information processing/transferring
- Sensing layer
 - IIoT devices, resources
- Database
- Connection



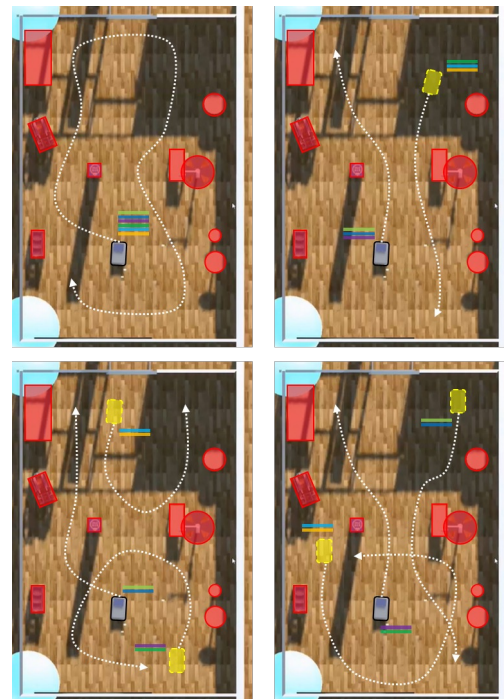
*Proposed architecture for Industrial Internet of Things-enabled digital servitization in smart production logistics



Digital twin applications



(a) safety distance/radius - optimal route test



(b) fleet management - optimal delivery task assignment

Paradigm shift

- from **technology-centric** approach to **value-driven** approach



Image source: Kuka

Industrial
Transformation



Image source: Kuka



Industry 5.0?

*“Industry 5.0 – or Society 5.0 – aims to solve **social problems** with the help of integration of physical and virtual spaces that would be **achieved by Industry 4.0.**”*

(Skobelev & Borovik, 2017)

Human-centric

*“Industry 5.0 recognizes the power of industry to achieve societal goals beyond jobs and growth to become a **resilient provider** of prosperity, by making production **respect the boundaries of our planet** and placing the **wellbeing of the industry worker** at the center of the production process”*

(European Commission, 2021)

Resilient

Sustainable

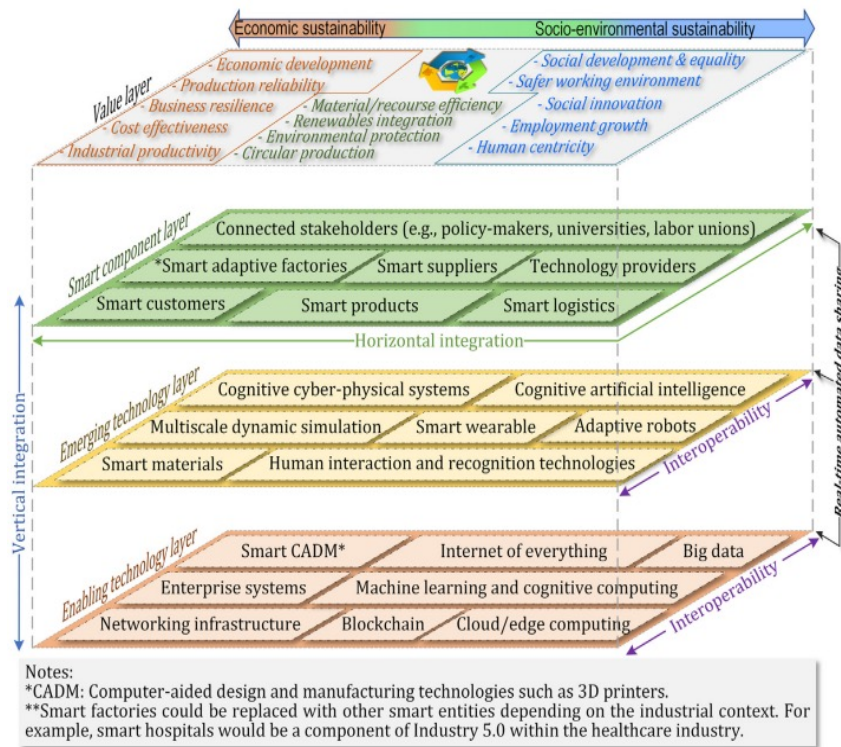
Industry 5.0 reference model

Economic sustainability **Socio-environmental sustainability**
 Value layer

Smart component layer

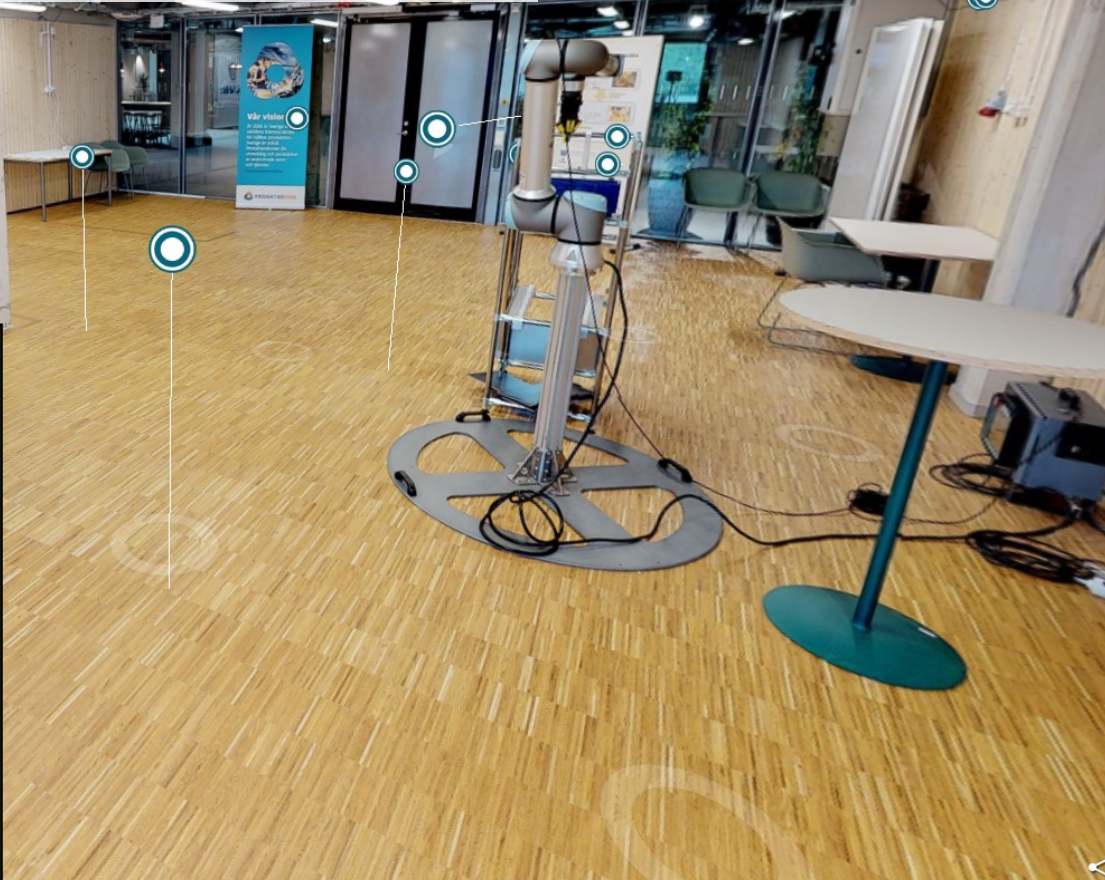
Emerging technology layer

Enabling technology layer



(Mukherjee et al., 2023)

Human-centricity in Smart Production Logistics



Monitoring Control Optimization Autonomy

Real-time location monitoring

Real-time status analysis

Monitoring Control Optimization Autonomy

Material handling route optimization

- A-C-G-J
- A-D-H-J
- A-E-H-J

Monitoring Control Optimization Autonomy

Utilization Energy consumption
Traveling distance ...

Optimize logistics schedule and task assignment

Monitoring Control Optimization Autonomy

Additional tasks

New KPIs

Additional resources

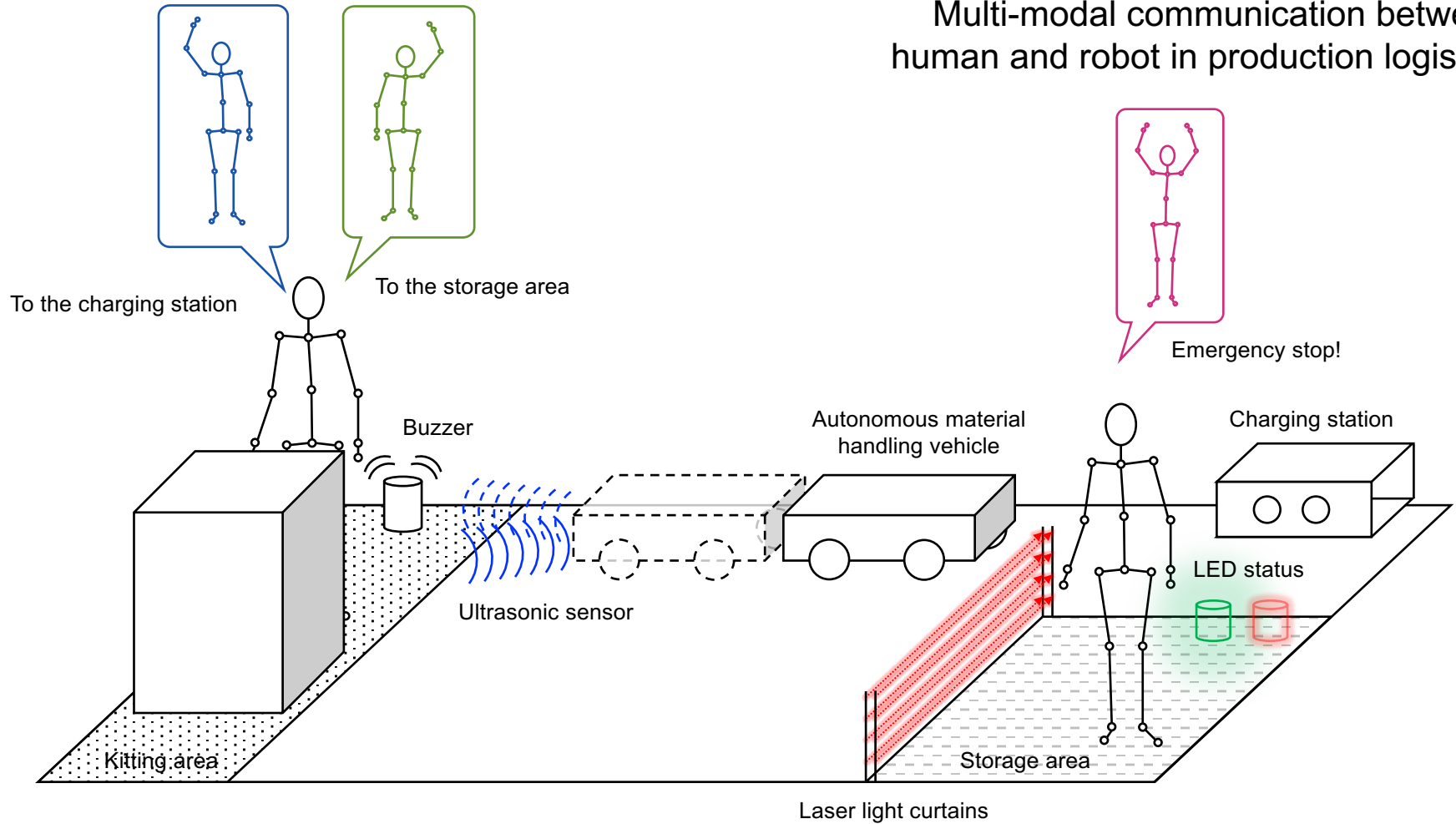
Alternative schedule A

Alternative schedule B

Alternative schedule C

Human-centric dashboard and digital services

Multi-modal communication between human and robot in production logistics





Distance (cm)



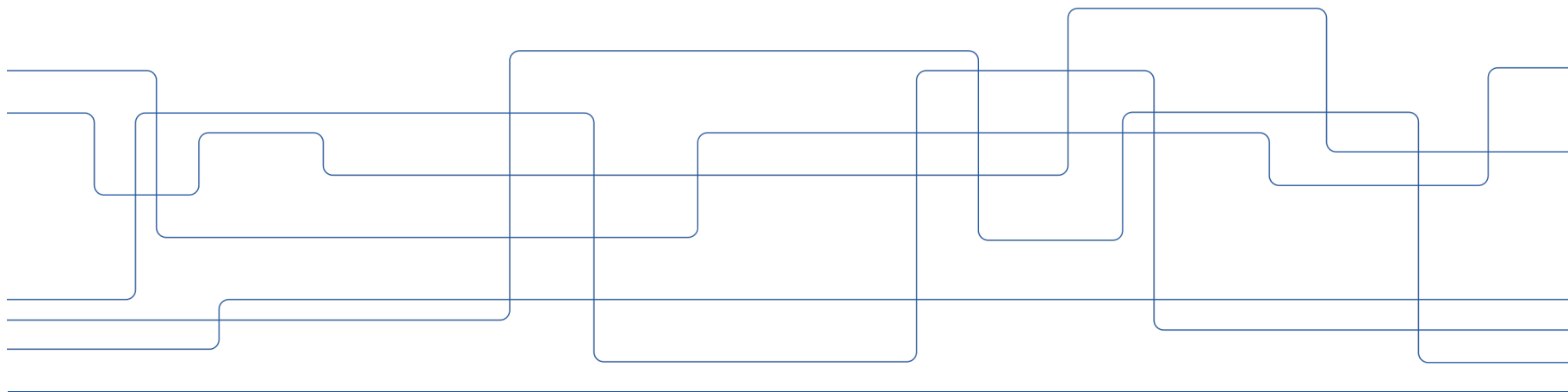
Next steps



- Increase automation in material handling
- Cost effective solutions for brownfield manufacturing sites
- Adapt dynamically to changes in the factory floor
- Smart product-service-software systems
- Adopt a value-driven approach

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Production Logistics

The flow of goods and information in a manufacturing facility is often key to an effective and efficient production system. However, production logistics are undergoing major changes. The pervasive digitization of all processes and the

Research at the department

- Industrial Production Systems
- Manufacturing & Metrology Systems
- Production Management and Logistics
- Production Management and Logistics
- Research themes
- Production Management and Strategy

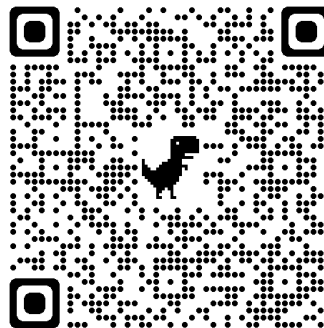
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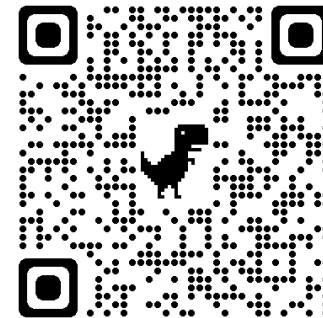
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Any questions?

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