Automated pin setting on container carrying wagons

Vision, conception and implementation

Celina Fuss (HHLA)
Johann Bergmann
(Fraunhofer CML)
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Agenda

1. Project overview
2. Initial situation
3. Potentials
4. Conception and implementation
5. Summary and outlook

Pin-Handling-mR – Project overview

A research project on developing and testing a robot prototype

Key facts

- Research project for optimizing terminal processes
- Funded by German Federal Ministry for Digital and Transport through IHATEC program (innovative port technologies)
- Project runtime: 2,5 years

Project stakeholders

TÜVRheinland® Genau. Richtig.

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HHLA Sky

HPC METRANS

Pin-Handling-mR – Initial situation

Currently the pin setting is a highly manual process

Source picture: HHLA/Thies Rätzke

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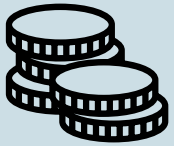
Pin-Handling-mR – Potentials

Automating pin handling offers high potentials

Increase of **work safety**



Reduction of **operational costs**

Contribution towards **sustainability**

Increasing competitiveness and securing jobs

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Pin-Handling-mR – Conception

The mobile robotic system is based on two main components

Integrated control center

- Interface to TOS
- Order management
- Mission planning
- Monitoring

Source picture: HHLA Sky – Integrated Control Center

Mobile robot

Hardware components

- Mobile platform
- Magnetic gripper
- Robotic arm
- Sensors

Functions

- Localisation & navigation
- Collision avoidance
- Object detection
- Manipulation

Source picture: Fraunhofer CML

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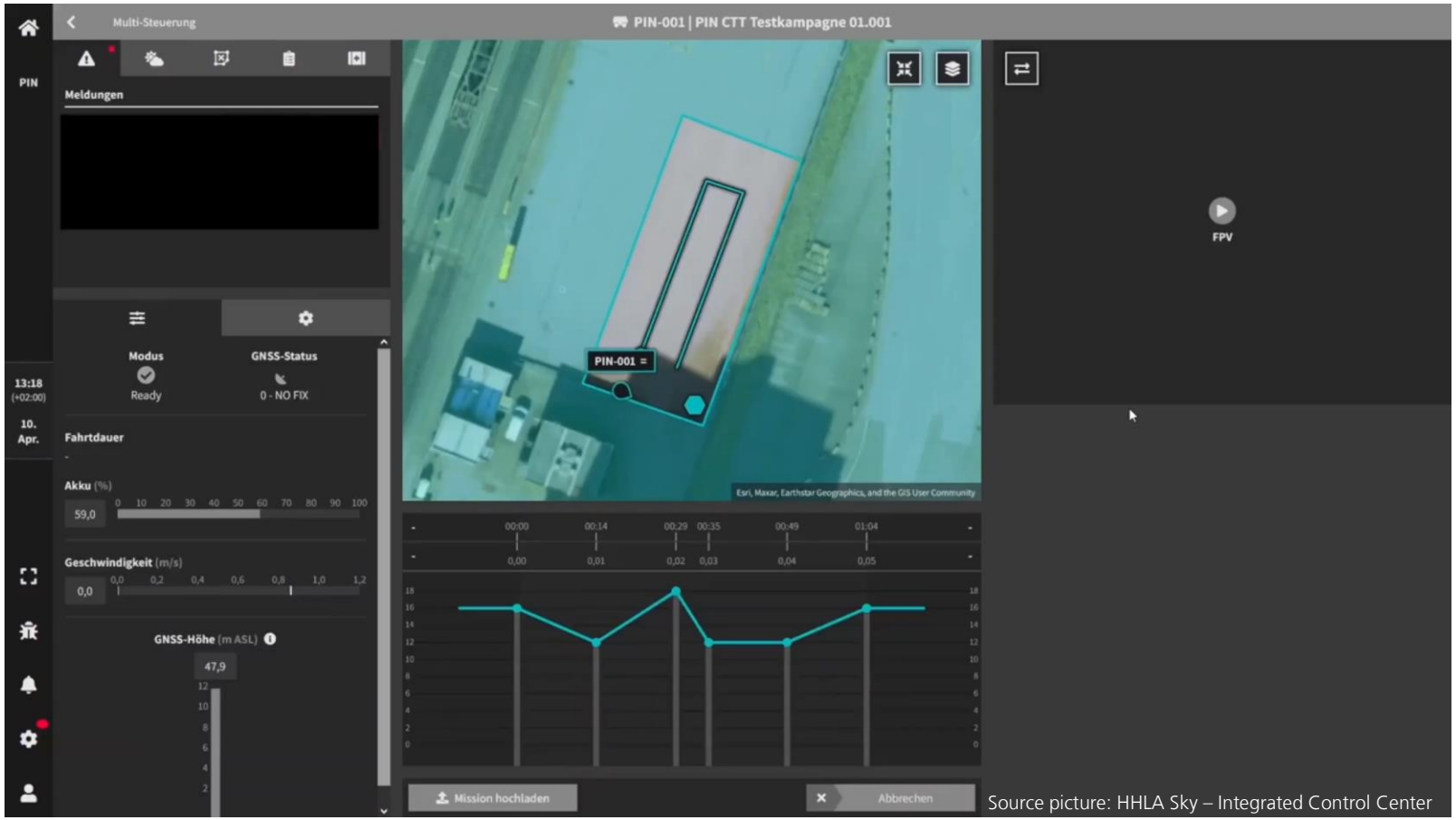
Pin-Handling-mR – Implementation status

Navigation

Navigation

- Initially: creating a reliable map of the train station
- Robot receives waypoints
- Localisation by fusion of GNSS and inertial navigation
- High localisation accuracy
- Navigation btw. trains supported by LiDAR & camera



Source picture: HHLA Sky – Integrated Control Center

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Pin-Handling-mR – Implementation status

Object detection

Object detection

- Use of state-of-the-art deep learning models
- Training data set: ~2500 pictures per relevant pin type
- A depth camera takes 3D information for finding appropriate pin grasp pose
- Integration in ROS (robot operating system)

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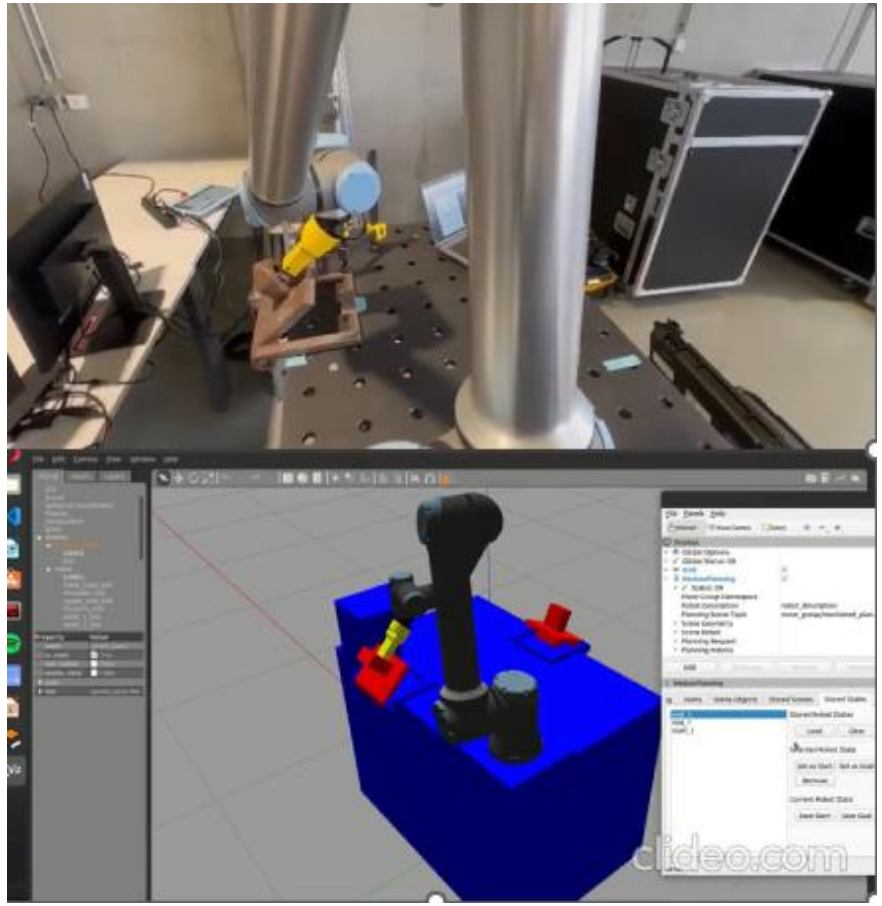
Pin-Handling-mR – Implementation status

Manipulation

Manipulation

- Cobot with a magnet gripper
- Use of 3D information
- Development of a simulation testing environment
- Tested at a demonstrator in the Fraunhofer CML lab
- Field tests at HHLA Container Terminal Tollerort to come



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Pin-Handling-mR – Summary and outlook

For more information, please visit us at M 38

- Suitable application for automation meets an innovative approach
- Development of a robotic application using “off-the-shelf” hardware considering given process and safety requirements
- Extension of the HHLA Sky control system for drones
- Pilot tests in Q 4 / 2024 and Q1 / 2025
- For more information, please visit us at M 38

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Fraunhofer CML

Contact

Celina Fuss

HHLA Container Terminal Tollerort, Terminalentwicklung

fuss-c@hhla.de

Tel. +49 40 3088 2691

Johann Bergmann

Fraunhofer CML, Group Port Technologies

johann.bergmann@cml.fraunhofer.de

Tel. +49 151 23214471