

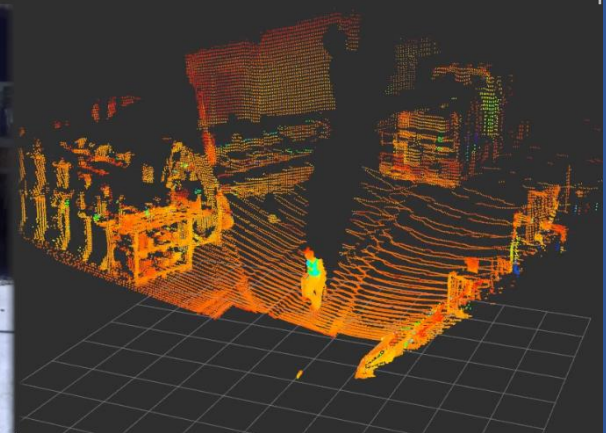
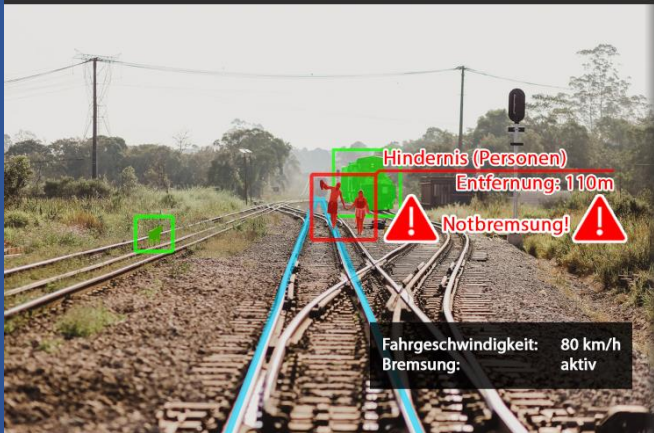
ikado

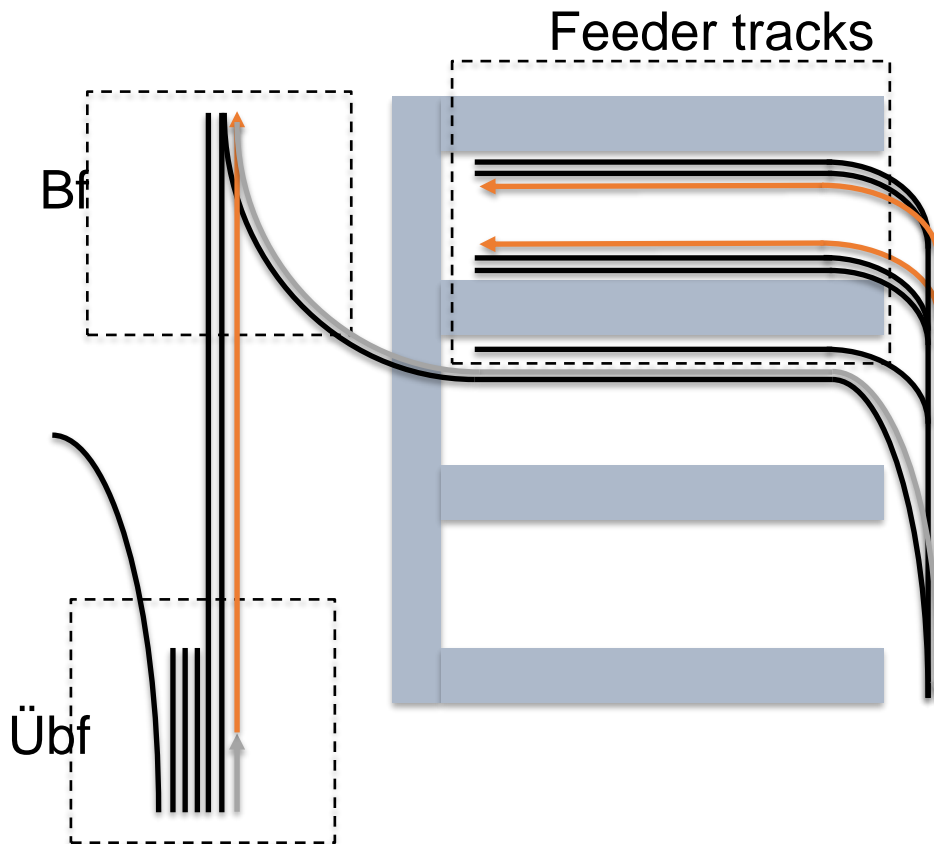
SAMIRA 2.0
RAIL SHUNTING SYSTEM

thysenkrupp

TECHNISCHE UNIVERSITÄT
IN DER ERDSTADT HAUPTSTADT EUROPAS
CHEMNITZ

Gefördert durch:
Bundesministerium für Digitales und Verkehr
 aufgrund eines Beschlusses des Deutschen Bundestages





pulled operations

pushed operations

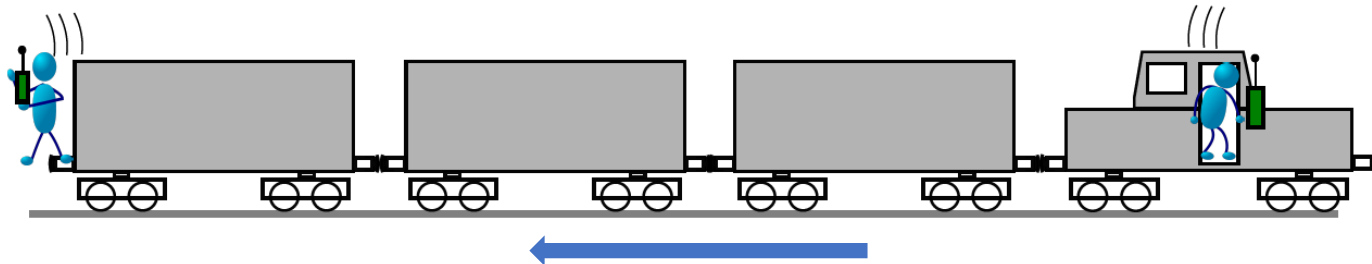
➔ multiple switch of driving direction necessary



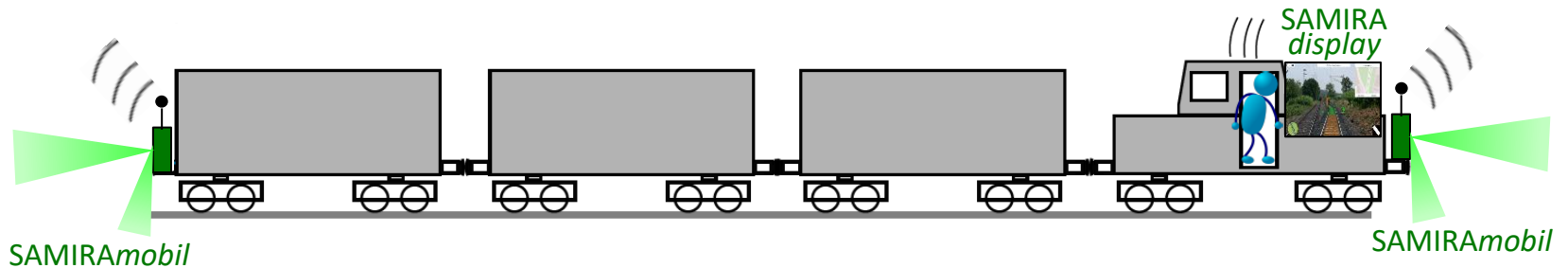
Problem

Shunting today:

two-man operation or one-man operation with remote control



or tomorrow:



- The costs for last-mile operations are too high and the flexibility is too low
- Demographic change and skilled labor shortage lead to deficits in logistical capacities
- Very diverse environments in the last mile



Technical Solution

- As an alternative to using a shunting assistant or a locomotive shunting driver (Lrf) to occupy the front, a digital system is used that captures and forwards the necessary information to the train driver.
- The perspective of the last wagon and other information are reliably displayed on the locomotive
- The goal of the SAMIRA project is to create the technical and organizational prerequisites for the production and practical use of such a system.






- High resolution video Stream
- Automatic detection and highlighting of obstacles
- Quick and easy attachment to all common types of wagon
- Operational capability in all weather conditions
- Minimum battery life is 8 hours
- Secure data/information transmission and system monitoring
- Warning in critical situations

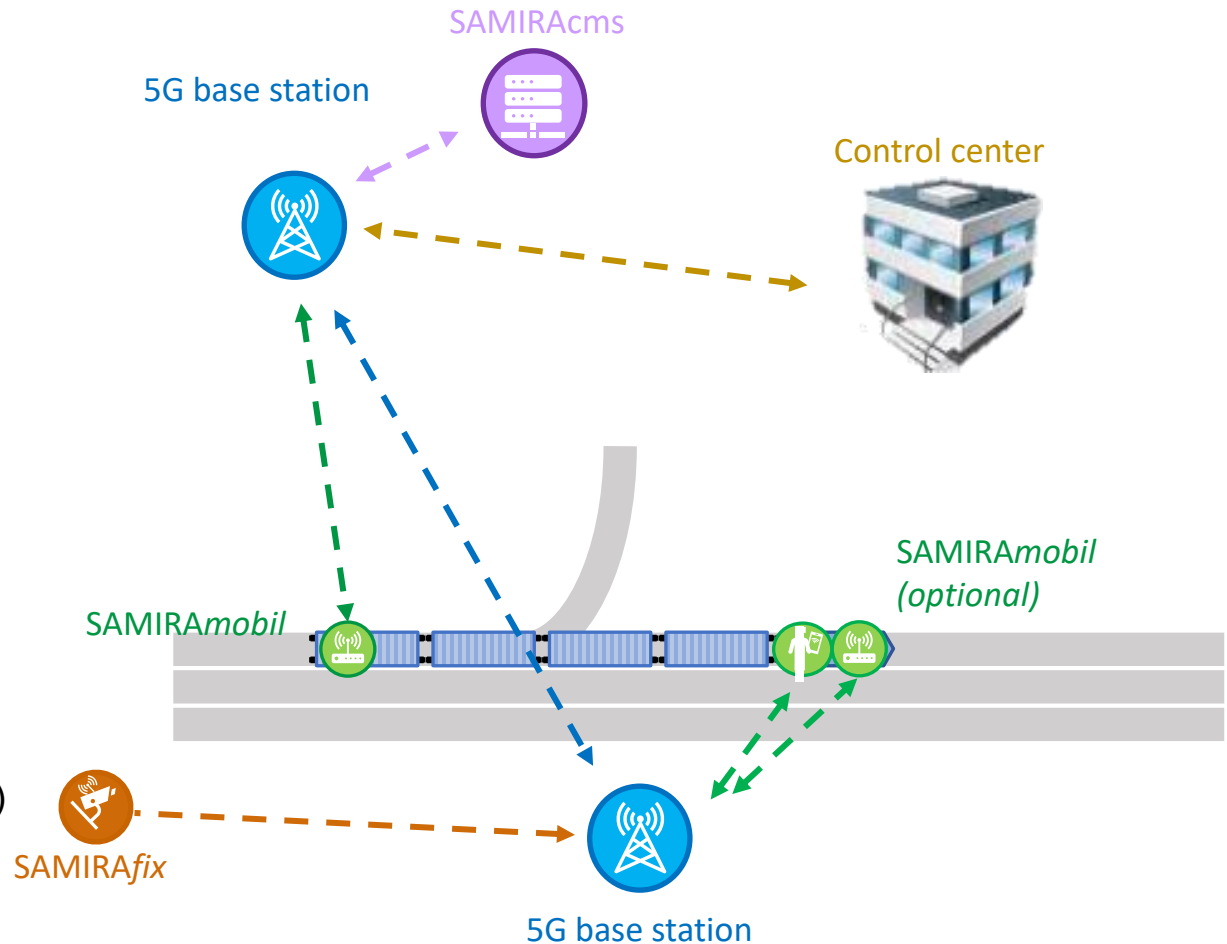


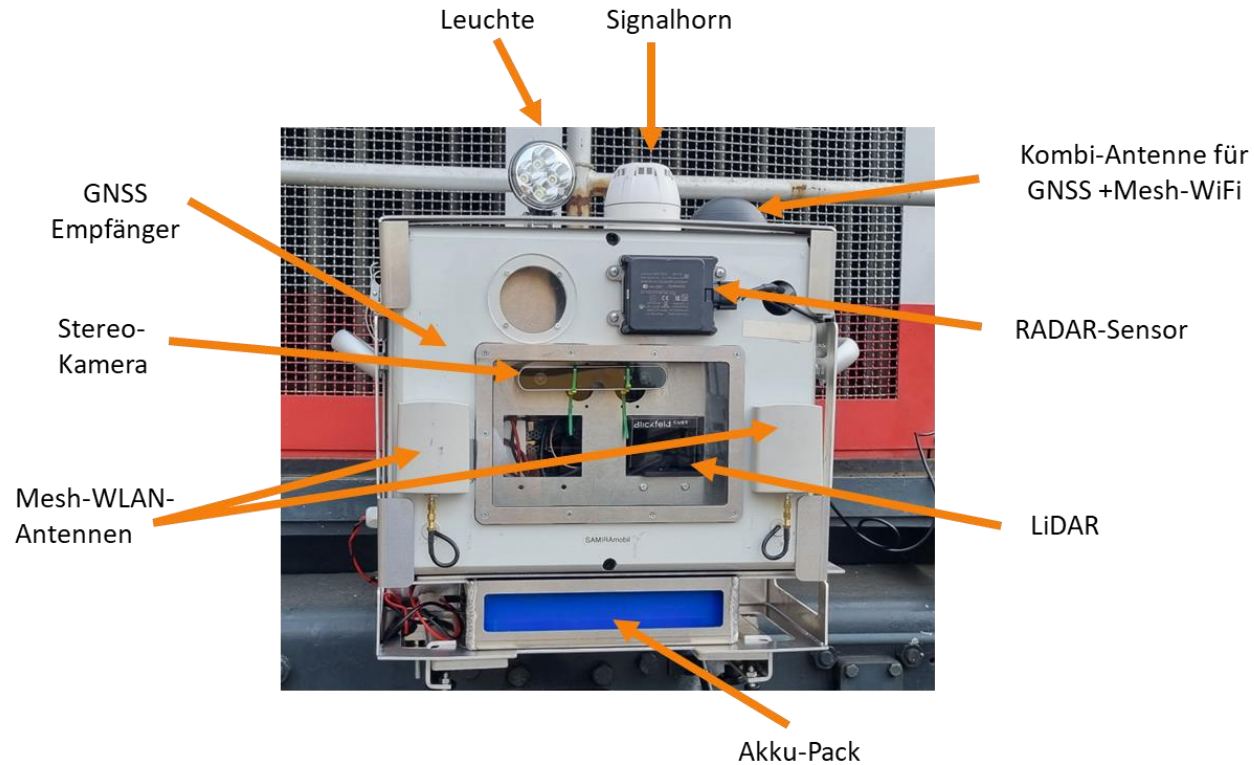
Data flow:

- Shunting Assistant
- Stationary track monitoring
- Control center
- Server

Components:

-  5G base station
-  Mobile unit (SAMIRAmobil)
-  Stationary unit (SAMIRAfiz)
-  Server (SAMIRAcms)
-  Display devices (SAMIRAhmi)



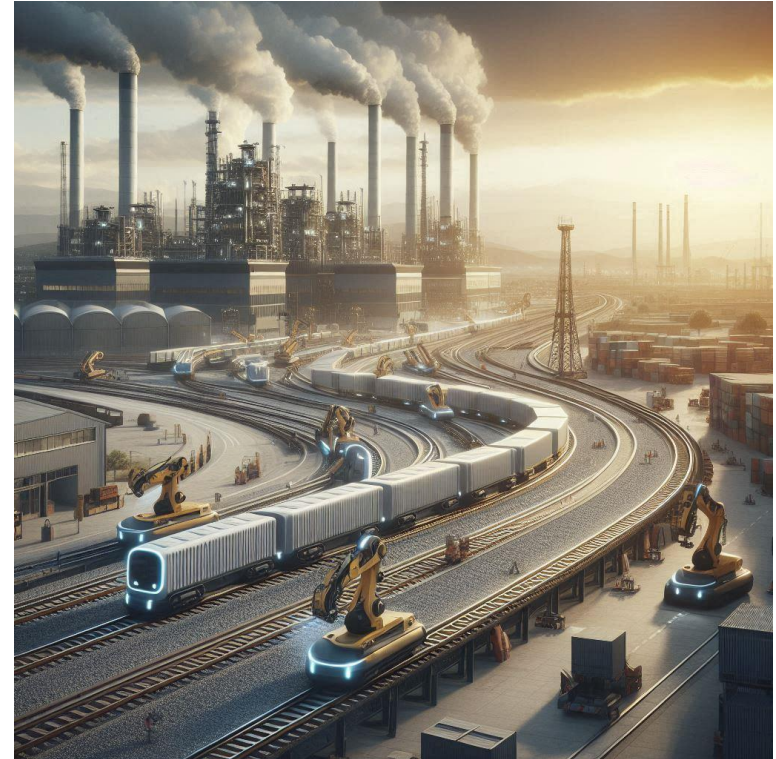


- Successful Proof-of-Concept
 - Data processing in SAMIRAmobil
 - Real-time processing and transmission of data
 - Power Supply (>12h) from battery
- Concepts for obstacle detection
- Localization even in challenging environments
- Attachment to multiple types of wagons



obstacle detection SAMIRA1

- Higher maturity level of the system(TLR7)
- Reliable obstacle detection
- Smaller and lighter design
- Flexible attachment
- AI optimized for last mile
- Data transmission with 5G
- Practical phase at Thyssenkrupp Steel Europe



Automatic shunting according to DALLE-3



Data aquisition

Annotation

Modeltraining

Pipeline testing

Validation

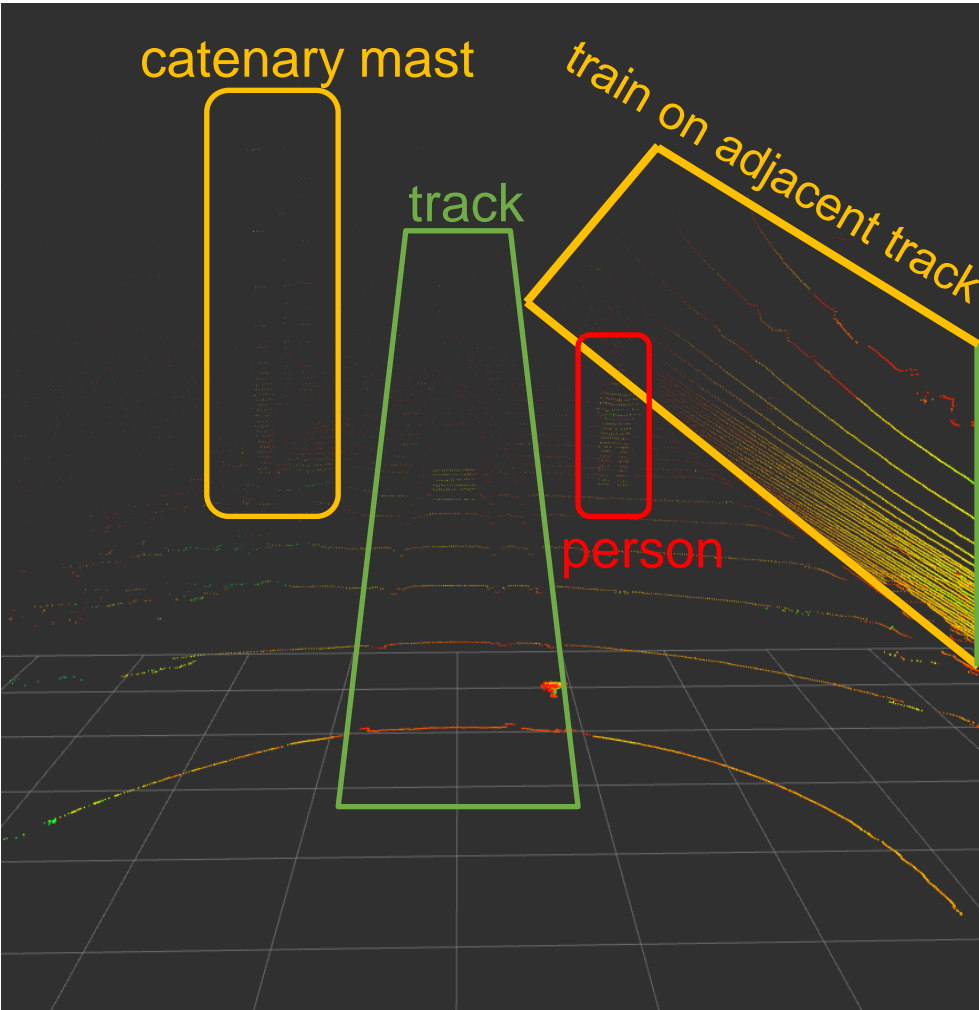


Train 0.94

- High-quality data for optimizing reliability
- Testing pre-trained models for SAMIRA as a use case
- Coordination with specialists and users
- Testing and Validation

Train 0.93
Train 0.49
Train 0.91

LiDAR detection



Display with Augmented Reality

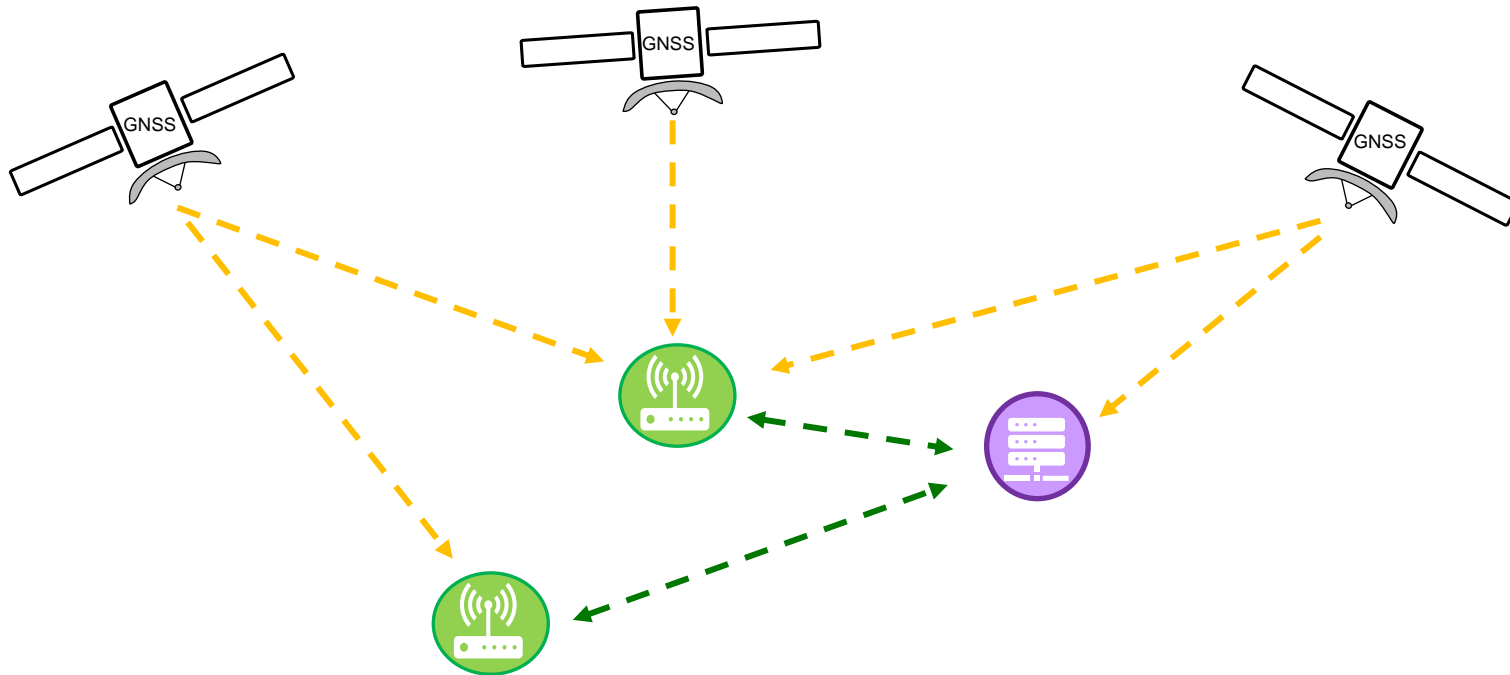
SAMIRA2.0
RAIL SHUNTING SYSTEM







Advantages of 5G as a transmission medium

- guaranteed bandwidth and latency
- comprehensive coverage
 - also usable outside the operational area
- Indoor connectivity through campus network possible
- key technology for further digitalization of the company

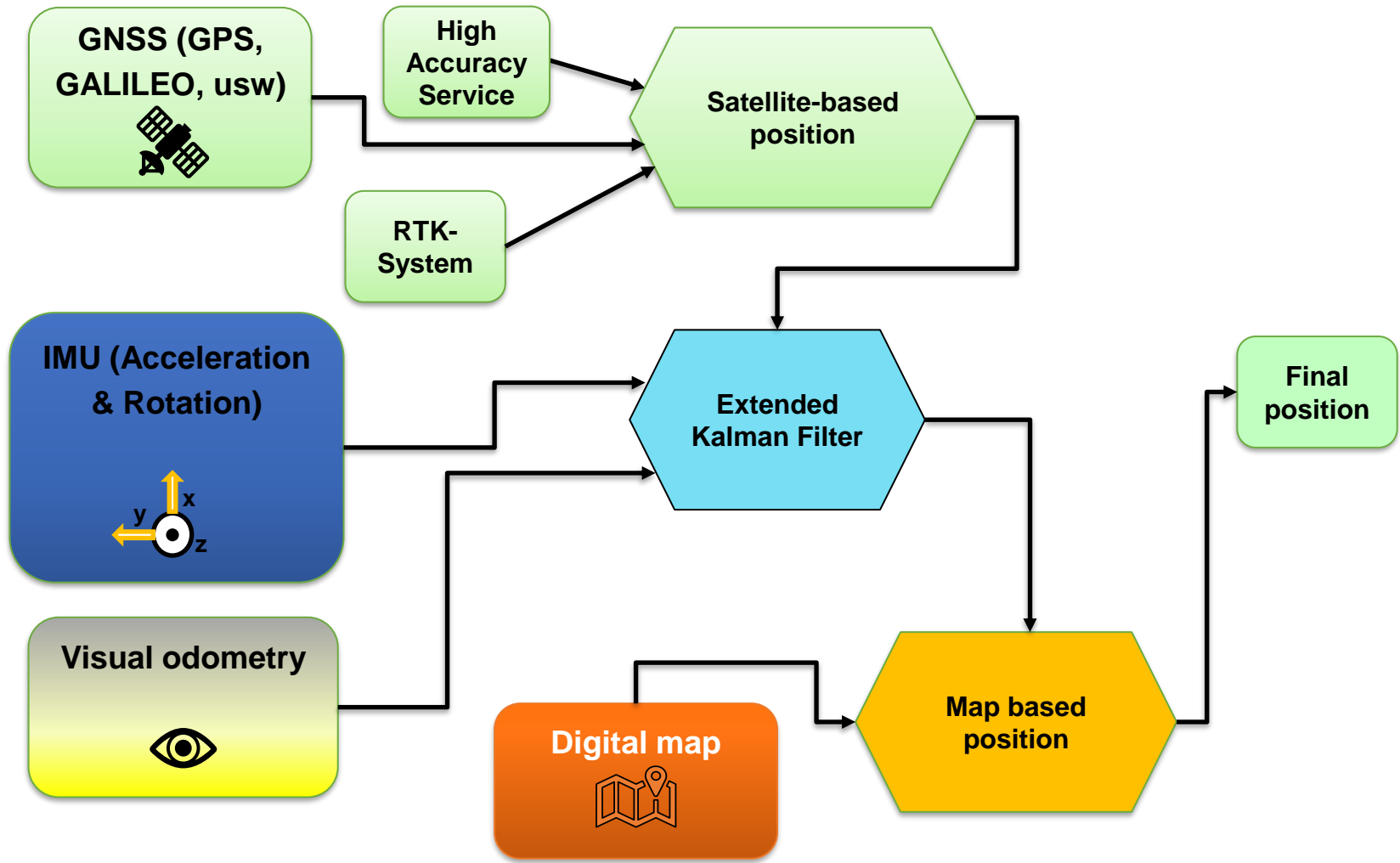




legend:

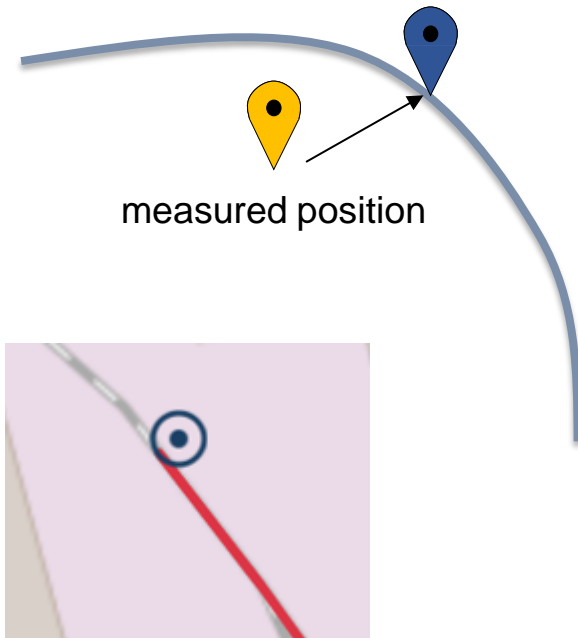
-  SAMIRAmobil
-  Server (SAMIRAcms)
-  high-precision GNSS time signal
-  communication between devices

- basis for monitoring real-time transmission
- Accuracy: approx. 100 μ s



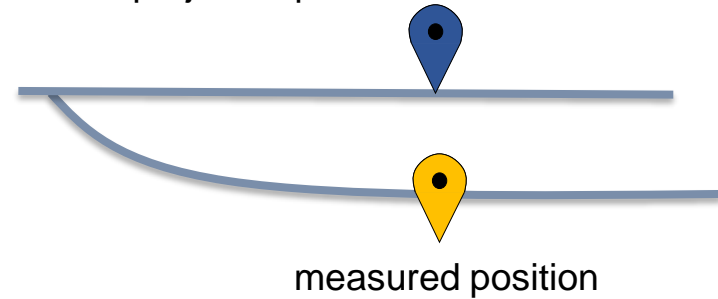
Simple scenario

track-projected position

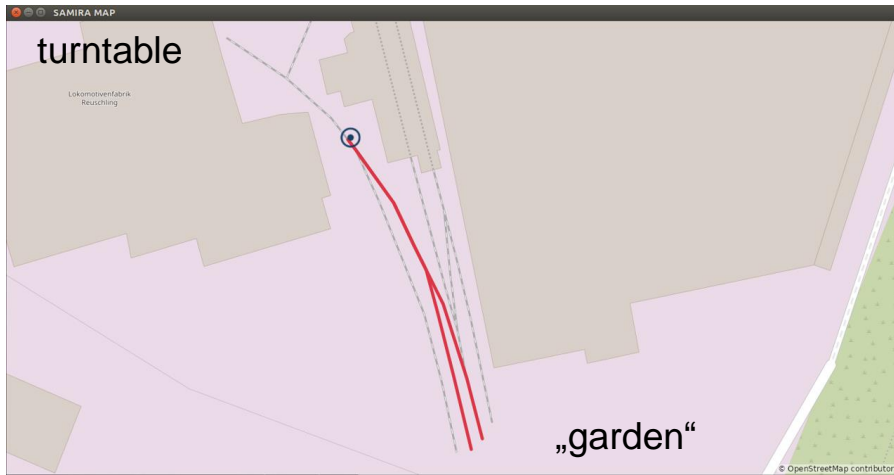


scenario with multiple paths

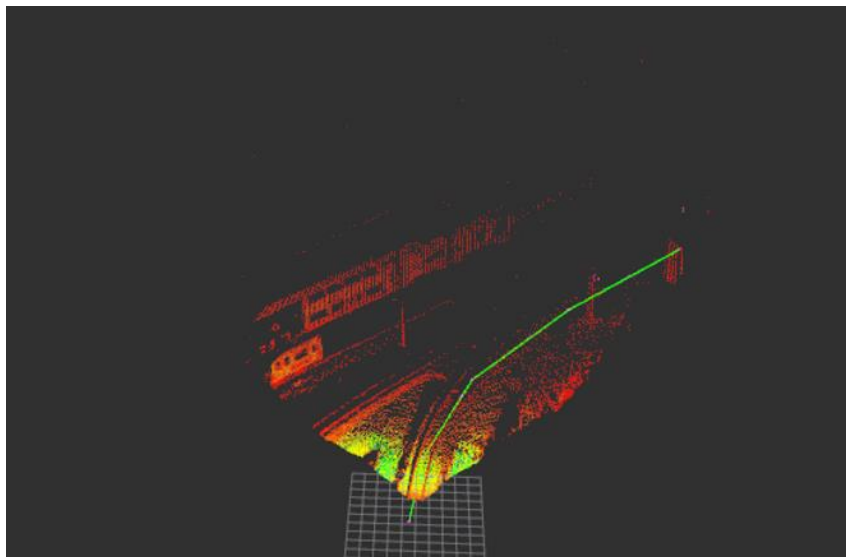
track-projected position



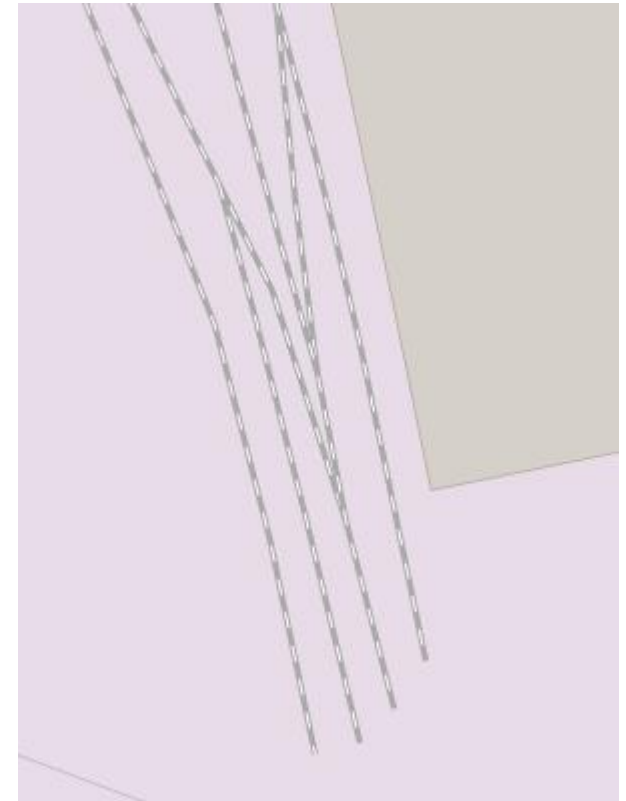
Determining possible routes



track layout Fa. Reuschling: possible routes



Path in LiDAR reference system



Enlarged map section

Local

- software for monitoring the functionality of subsystems
- subsystems generate status messages

TOPIC	INPUT DELAY	PROCESSING DELAY	CHAIN DELAY	DATA VALIDITY
GNSS/Node_Status	OK	OK	OK	OK
IMU/Node_Status	OK	OK	OK	OK
lidar/node_status	OK	OK	OK	OK
/samira_radar/Node_S	OK	OK	OK	OK

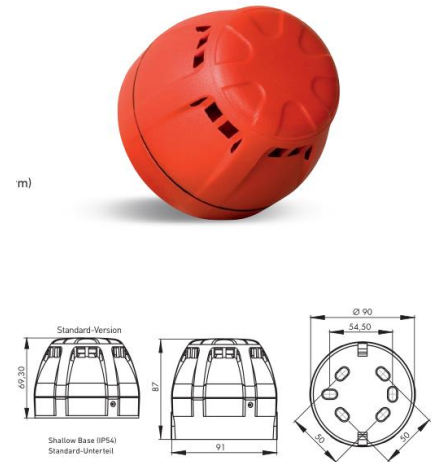
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Global

- The global system monitoring is largely based on the depicted local system monitoring

Warning signals horn and light

- horn and light are operated from the HMI
- control via relays (GPIO)
- failure detection through voltage and current measurement





Demonstrator sensor module SAMIRA2

Tasks of the project partners:



❖ IKADO

Software architecture, development + testing, Positioning and navigation module, Obstacle detection with LiDAR and RADAR, Object position and distance, system integration, AI development



❖ TU Chemnitz

Integration of 5G Digital test field in the Erzgebirge, Data transmission, Test runs on public tracks



❖ ThyssenKrupp Steel Europe

Railway-specific requirements (operation) + standards, Runs for synchronous recording of sensor data (camera, LiDAR, RADAR, SatNav), Measurement, test, and validation runs

Thank you!

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SAMIRA im Web: <https://samira-rangier-assistent.de/> (inkl. Video)