Optimizing Production Flexibility with Automated Guided Vehicles (AGVs)
DIGITALIZATION
Digitalization

Helping the manufacturing industry go digital as companies move toward Industry 4.0
We are driving the Digital Enterprise with our solutions along the entire value chain for industry.
The Digital Transformation in production is mainly driven by change in product, production technology and processes.

...driven by the change in product
- Car connectivity
- Software defined car
- Battery manufacturing
- Autonomous driving

...driven by the change in production technology
- Digital Twin
- Collaborative Manufacturing
- Flexible production concepts
- Assistant systems (google glasses, lift devices)

...driven by change in processes
- Product design process
- Virtual engineering & commissioning of production line
- Digital enabled production process steering and optimizing
- Predictive maintenance
One of the first American AGVs, built starting in 1954, working as a tractor for five trailers.
Source: Barett-Cravens/Savant Automation (1958)
AGV enables the flexibilization of production

Source: https://www.youtube.com/watch?v=kfISmVGcjxg
Highly flexible transportation of goods
Flexibilization of production with AGVs – Requirements and Challenges

Production area
- Integration in production automation
- Integration in plant safety concept
- Reliability, availability, life-time

Optimal plant integration

Logistics area
- Highest demand on dispatching
- Flexibility in routing & obstacle avoidance
- High variance of vehicles

High variance of AGVs

Technologies
- Usage of car components e.g. power supply, environmental sensors
- Make driver assistance technologies suitable for the industrial use

Benefit from vehicle sensorics
Flexibilization of production with AGVs – Benefits and improvements

- Lower rework costs due to immediate response
- Increase product quality

Optimize product quality

- Stations are independent modules
- They can go-on and off-line whenever needed without affecting others

Increase throughput and availability

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Our AGV approach benefits from the digital tool chain and becomes a key element of the Digital Factory.
Automation in interaction with Plant Simulation
Offline engineering reduces commissioning costs
SIMOVE in interaction with Plant Simulation
Process Simulate for layout optimization
Flexibilization of production with AGVs –
Market situation in Automotive

Substitution of traditional conveyors

Manufacturers specify on concepts for smart factory solutions

Customers build up know how on AGV technologies (e.g. navigation)

Several car manufacturers develop their own AGVs

Many individual solutions, but the request for standardized solutions
Siemens addresses the AGV market with the development of a system package

SIMOVE – Standardized solution for AGV applications

Use of standard automation and drives components + tailored application software

Easy system extension via open interfaces and 3rd party integration

Competence team for application support
SIMOVE – The comprehensive system package for AGV automation

Master Control SW

Enables machine builders and manufacturers to automate...

Navigation SW

Carrier Control SW

... AGV applications with Siemens components and technologies

Maintenance SW
SIMOVE – Maintenance Apps tailored for different applications and users

Dashboard:
- KPI monitoring
- Dispatch order per AGV
- Route information incl. status per AGV
- AGV's location
- Battery status of AGVs
- System alarms
- Equipment diag
Automation and Navigation –
Integration of different AGV disciplines into one common system

• Combine automation and navigation on one common HW platform
• Using appropriate operating systems
  Navigation: Linux - Automation: PLC
• Integrated Safety supporting PROFIsafe

AGV Automation Platform

Navigation on PC
Control on PLC

CPU1515 SP PC2 „Open Controller“

Drive functions
SIMOVE –
Support of all kinds of navigation, Siemens’ navigation based on ANS+

Carrier functions:
- Localization
- Route following
- Obstacle avoidance

Engineering:
- Map Management
- Route Management

Track guided Navigation
- Proven technology
- Integrated in SIMOVE
- Already used in projects

Free Navigation
- Siemens ANS+ Navigation
- Integrated in common HW platform (PLC+PC with Linux)
- Supports 3rd party integration via open interface

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SIMOVE – Integration of different AGVs in one common fleet management system

Host Systems (SAP, ITLS, PLUS)

- Visualization
- Modelling
- Dispatch
- Routing
- Alarming
- Master Control

- Siemens offers both: PLC-controlled (PLC+WinCC) and PC-controlled (Windows+WinCC OA) fleet management
- Integrated safety functionality
- Scalable architecture enables system expandability
- Open interfaces to AGVs simplify integration of different suppliers
SIMOVE – Automate with standard automation and drives components

- Basic functions
- Communication
- Track management
- Drive train
- Energy supply
- Safety-functions
- Additional onboard functions e.g. lifting

Recommended component list tailored for different types of AGVs

Preconfigured “TIA AGV project” and library with function blocks
Totally Integrated Automation –
A comprehensive product portfolio for all kinds of AGV automation

Operations
- SCADA System
- Totally Integrated Automation Portal
- Energy Management

Controls
- Controller
- HMI
- IPC
- Communication
- Motion Control
- CNC
- Engineering Framework

Field
- Power Supply
- Industrial Identification
- Distributed I/O
- Drive Systems
- Industrial Controls

Integrated product portfolio paves the way for the Digital Enterprise

• Basic functions
• Communication
• Track management
• Drive train
• Energy supply
• Safety functions
• Additional onboard functions e.g. lifting
AGV business Potential for Automotive only

Amount of AGVs potential by type 2018 – 2023

1) Source: PwC AutoFacts market study for SAG, Date: 06/2018
Future Scenario –
Self organizing production areas

- Decentralized collaboration of autonomous Robots and autonomous AGVs reduces engineering efforts

- Automatic assignment of AGV: Decentralized task requests ➔ negotiation ➔ task assignment

- Auto-scaling of manufacturing equipment depending on production needs and load

Source: Collaborative Embedded Systems (CrEST)
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