Automated guided vehicles (AGV) play a key role in making production processes more flexible. Under the name TCS (Traffic Control System), SIGMATEK introduces a **vehicle manufacturer-independent AGV control system** to the market that, with open standard protocols such as VDA 5050, MQTT, JSON, UDP and TC/IP, can connect anywhere.

MANUFACTURER-INDEPENDENT AGV CONTROL

When making production processes more flexible for implementing adaptive manufacturing strategies, automated guided transport systems play a key role. They are mostly controlled using proprietary systems from their manufacturer or via individual programming. SIGMATEK is introducing a manufacturer-independent AGV control system, which can not only be easily integrated into automation solutions but also used independently of them. For the first time in their company history, the Austrian automation systems manufacturer will offer a pure software package. **From Ing. Peter Kemptner, x-technik**

Increasingly faster innovation cycles and demand for mass-produced products with individualization requires very high flexibility from the manufacturing industry. This can only be achieved with a high level of automation based on digitized product and production data. The so-called digital transformation can only deliver the desired results with the complete automation of production systems. In addition to machines, they must also include the robots and handling devices, as well as the entire conveyor technology.
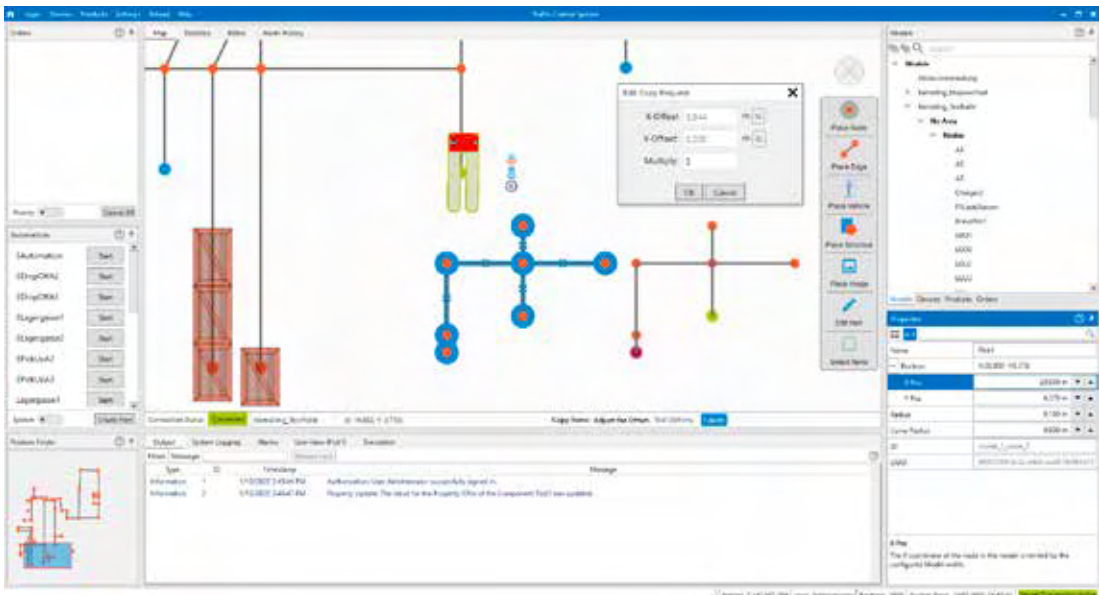
SIGMATEK TCS can not only be easily integrated into automation solutions, but also used independently of them. It provides an **easy-to-use graphical editor for creating tailored system layouts.**

To Industry 4.0 via AGV

In this area, automated guided vehicles (AGV) are more frequently replacing previously common static installations. They not only relieve personnel from repetitive and time-consuming process steps, but can also be more easily adapted to changed requirements, operations and transport routes. For workpiece transport, assembly line design and intra logistics, they provide the basis for adaptive, self-optimizing production processes of Industry 4.0. In most driverless transport systems, the automated guided vehicle (AGV) performs navigation tasks on board. They thereby process transport jobs, which they receive from a primary control.

Market Niche Independent AGV Guidance System

"The systems from established, market-leading manufacturers are often self-contained", explains Alexander Melkus, CEO at the Salzburg automation systems provider SIGMATEK, and expands: "In recent times, new fully autonomous vehicles are even less suited for integration. They are more ideal for factory operation than for use as a component in the overall automation of an industrial company." This problem and the resulting hurdles to integration are well known in the professio-

nal world and have led to efforts to standardize. The first result of these efforts is the VDA 5050, a standardized interface for communication between AGVs and master controllers, defined by the German Automotive Industry Association (VDA) and the Association for Materials Handling and Intra Logistics within the German Engineering Association (VDMA). This enables, for the first time, the integration of AGVs from different manufacturers into a guidance system. SIGMATEK has had its ear to the ground in the AGV market for years. After all, SIGMATEK systems operate as on-board computers in the vehicles of several European AGV manufacturers. "We recognized that a manufacturer-independent fleet management system was a market gap, and we decided to fill it", explains Alexander Melkus.

Between the ERP System and Vehicle

SIGMATEK's guidance system is called TCS. That stands for Traffic Control System. As such, the software operates as the intermediate level between the vehicles themselves and the inventory control and warehouse management systems. From these, SIGMATEK TCS receives transport orders. Much like a taxi dispatcher, the guidance systems sends an available vehicle to the pickup point and then to the delivery address. **>>**

❞ With SIGMATEK TCS, we offer a comprehensive AGV fleet management system with flexible integration options that can be used without SIGMATEK systems.

Alexander Melkus, CEO of SIGMATEK GmbH & Co KG
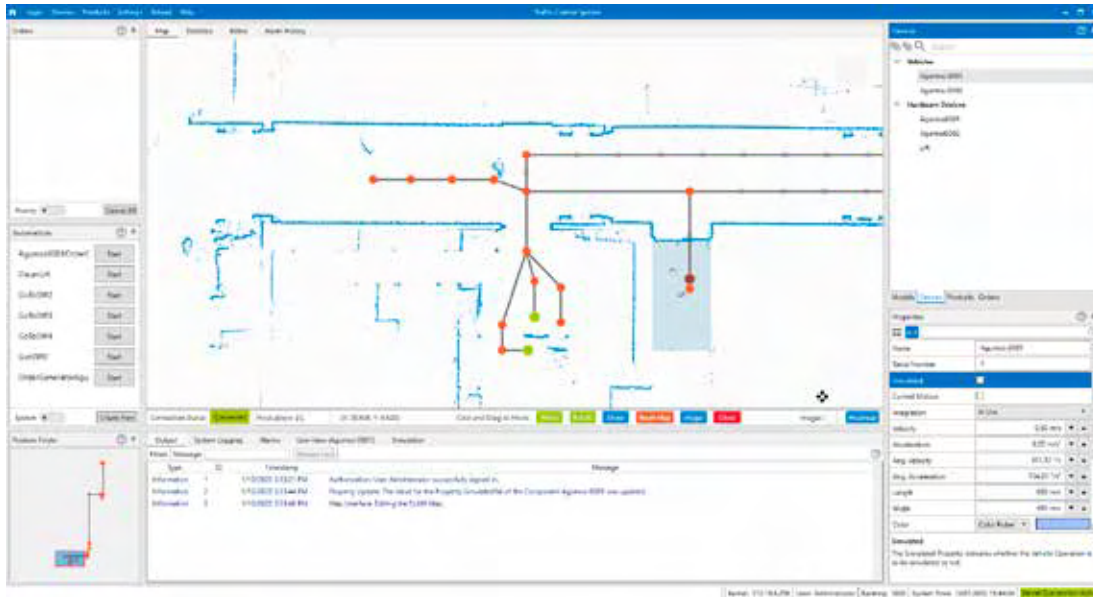
SIGMATEK TCS provides the option, for example, to import **real data from automated guided vehicles via SLAM navigation in order to adapt the map to the actual conditions.**

The system receives the transport order for the individual vehicles and handles the route planning. If there is no inventory management system upstream, transport jobs can be created in the TCS directly. The transport job process is freely programmable. In this case, TCS takes specific features of the possible routes into account, such as one-way streets, permanent or temporary obstacles, or user-definable restrictions.

Adapting to Reality

When creating floor plans, theory rarely matches reality. SIGMATEK therefore provides the TCS with the option to import real data, so that the map can be adapted to the actual conditions. This can, for example, be captured by automated guided vehicles while navigating with the configured SLAM process. For creating the route planning application, SIGMATEK TCS provides planners with a graphic interface. Important functions of this GUI, such as the map editor, are web-based and can also be used with mobile end devices for quick access on the go. In the graphical editor, individual vehicle types and transport containers can be created and instanced as desired. This can be based on imported documentation from their manufacturer or in the form of generic definitions. The function

of the individual vehicles at the individual stations is also specified.

Avoid Traffic Problems and Dynamically React

"The most important distinguishing feature between good and not-so-good AGV guidance systems is their capacity for efficient and dynamic traffic planning" knows SIGMATEK applications engineer Gerhard Veldman, who played a leading role in the development of SIGMATEK TCS. "It's all about efficient order processing with the lowest possible route occupancy." Right of way rules (Route sections accessible by foot, receivable loads etc.) and the power status of the vehicle battery must be considered. The ability to dynamically react is an essential part of route planning. If an obstacle is reported for example, or the map is updated, the TCS immediately reacts and determines the best possible route for all vehicles affected by the new conditions. SIGMATEK TCS provides the ability to avoid obstacles. The system can move around obstacles or switch to alternative routes. If the vehicle has to leave the route, the system even takes the load width into consideration. Due to various safety aspects, areas over which the AGV can detour must be explicitly defined. The graphical map editor provides a user-friendly way to do this.

> ❚❚ The strengths of the AGV guidance system TCS include flexible, freely programmable handling of orders, efficient and dynamic traffic planning, as well as extensive analysis options. This means that AGV systems can be customized to installations with a wide variety of requirements.

Gerhard Veldman, Applications Engineer at Sigmatek GmbH & Co KG

The visualization shows permanent, real-time display of the location, direction of movement, speed and battery power status of the individual vehicles

Simple Hardware Integration

Configuring an AGV guidance system also includes integrating the devices. Simple things, such as traffic signals or barriers, can be quickly and comfortably added and configured. To integrate complex node types, such as rolling doors or lifts, pre-defined interface routines are provided in the program library. The physical hardware connection for the surrounding control or automation systems, as well as ERP or warehouse management systems, is made via the MQTT interface or over an HTTP Representational >>
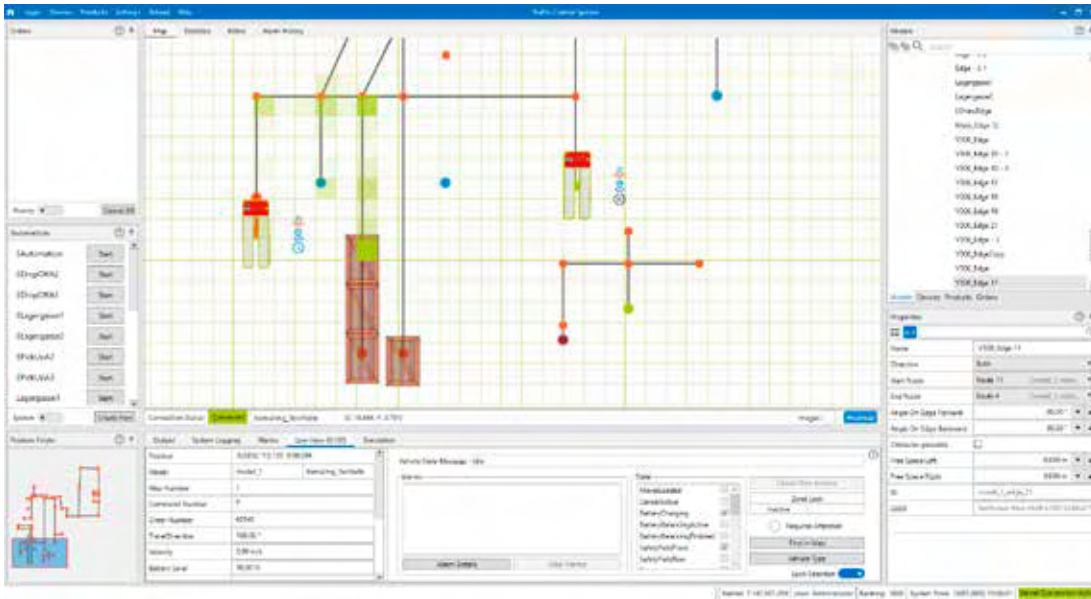
Heat maps superimposed onto the plan allow conclusions to be drawn in regard to congestion and other traffic conditions.

State Transfer (REST) Application Programing Interface (API). For integration into the SIGMATEK software suite LASAL, SIGMATEK TCS provides its own library, which makes hardware mapping especially simple. Users of other systems map the signal designations from SIGMATEK TCS to the hardware used via the interface documentation provided in the respective engineering system. The WLAN is also integrated via mapping with the communication type assigned depending on the type of vehicle used. Some manufacturers use UDP protocols for example, whereas the VDA 5050 specifies MQTT.

## Safety via Simulation and Analysis

Above all, the ability to simulate the processes is most important. In SIGMATEK TCS, this simulation is run up to 720 times faster than the real process. An entire day can therefore be mapped in two minutes. The visualization also provides safety during active operation. The vehicle movements are thereby permanently displayed in real time with all status information. Location, direction of movement and speed, as well as the battery power status of the individual vehicles are shown on the 2D map. Heat maps superimposed onto the plan allow conclusions to be drawn in regard to congestion and other traffic conditions. An analysis module immediately reports all errors as well as alarms and enables troubleshooting.

Complete Independence

"With SIGMATEK TCS, we offer a comprehensive AGV fleet management system that can be used without SIGMATEK systems", states Alexander Melkus. Just like the full kinematics integration of a 6-axis robot into the control system of a machine tool, the integration of an automated guided vehicle into the overall automation of a production line can, of course, also make a lot of sense. "As described above, this is possible with little effort using SIGMATEK TCS", confirms Gerhard Veldman and expands: "Of course, it is easiest with a SIGMATEK system."

www.sigmatek-automation.com
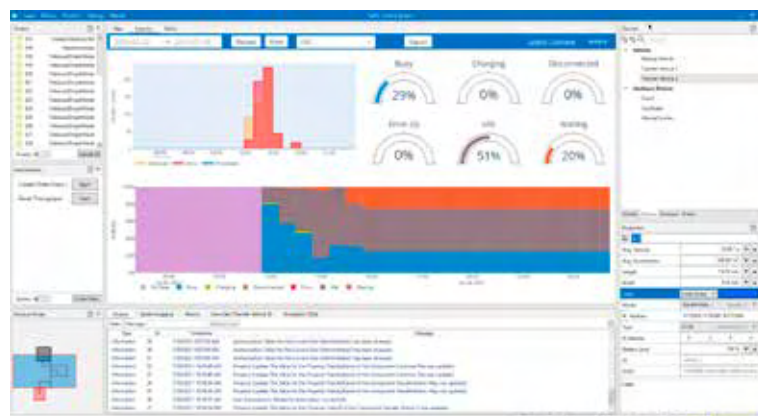
An analysis and statistics module provides fleet efficiency at a glance. It immediately reports all triggered errors and alarms, shows for example, which replacement vehicles are available if required and enables precise evaluation of incoming orders, throughput, or error causes.