Clever Chauffeur

Turck is supplying Movexx with most of the automation required for an automated guided vehicle, including the programming of the Codesys controller on the HMI VT250

A look at the operating steps taken over by the industrialization and automation of machinery will show that in the industrial revolution these were primarily operating steps requiring physical effort, which could be handled by steam engines. With the onset of automation (third industrial revolution), it was then increasingly easier but monotonous tasks that were passed on to robots and other machines, such as welding, screwing or turning. Tasks that involve a degree of flexibility are mostly still completed manually even today. The machines mainly do not have the required intelligence to make the right decision on their own.

The truck and automotive supplier VDL Weweler in Apeldoorn, Netherlands, wanted to automate a transport operation requiring physical effort, but which has to be completed at the demand of the production system. The company develops and produces leaf suspension systems and air suspension systems as well as special axles for buses, trucks and

Powerful chauffeur: The AGV receives the order wirelessly to move the frame with metal carriers to the painting line

QUICK READ

In the suspension systems production area at the Dutch company VDL Weweler, an automated guided vehicle (AGV) supplied by Movexx transports components for suspension systems from the basic production area to the paint line. Turck's HMI VT250 with a Codesys controller is controlling how the vehicle finds its destination, supported by photoelectric sensors, RFID system as well as angle sensors and status indication systems from the Turck portfolio. Turck B.V. demonstrated its genuine solution expertise by not only supplying components but also programming the controller. Since the AGVs have taken up their duties in production, the error rate for the transport of components has rapidly dropped.

truck trailers. The production area at its headquarters is mostly automated. The reliability and just-in-time availability required in the utility vehicle sector would otherwise be unachievable. Production runs 24 hours a day five days a week.

The responsible production planners saw the need for optimization in the transport of support elements and suspensions for truck trailers. Up to the middle of 2015, these components were still being transported between the basic production area and the paint line with lift trucks. At the end of the basic production process, robots place the support elements and suspensions on a frame. The fully laden frame was then fetched with lift trucks and placed at one of the two pick-up stations of the paint line. Robots here lift the components from the frame and hang them in a conveyor belt that takes them to the paint line. A suspension element weighs 35 kilos and a frame holds 36 of them. A fully laden lift truck including frame thus weighs almost two tons on the scales.

Manual transport unprecise

The disadvantage of this solution was the fact that it required a lot of physical effort from the employees: Furthermore, colleagues could not always work as precisely as an automated vehicle – with a weight of two tons on the lift truck hardly surprising. The stands always have to be placed exactly in the guide markers so that the robots can place the supports or lift them correctly. If they stood slightly wrong, the robots would collide with the frames. The rods would bend and production would have to be stopped.

In 2014, the decision makers at VDL Weweler therefore decided to automate the transport of the frames. As well as the pick-up stations (A and B) at the basic production area two offtake stations (C and D) are located at the paint line. The required transport system cannot be controlled according a fixed cycle. Sometimes a frame has to go from A to D, and sometimes an empty frame has to go from C to A and so on. "The transport solution for us had to be as flexible as possible," says Bert Eilander, shift manager in the production area at VDL Weweler.

Movexx develops new AGV

The decision makers at VDL Weweler turned to the transport specialists at Movexx International B.V. to develop an automated transport solution. Movexx is a Dutch manufacturer of industrial trucks including many customer-specific products. The manufacturer had already developed and built so-called AGVs (automated guided vehicles). However, a new solution had to be developed for this task.

"Several features of the AGV were new: The bidirectional driving capability, the extremely low construction for moving underneath the frames and the hydraulic heavy load lifting platform," explains Andreas Versteeg, product manager for AGVs at Movexx and responsible for the newly developed vehicle for VDL Weweler. The AGV must move in both directions because it is only possible to reverse out of the target stations. The hydraulic lifting platform raises the frame two centimeters from the floor in order to transport it.

> »The key factor was Turck's ability to offer a complete solution for automating the AGV.«
>
> **Andreas Versteeg | Movexx**

Comprehensive automation solution from Turck B.V.

To develop the transport vehicle, Andreas Versteeg got Turck on board already in the planning phase. Movexx had previously used the Turck sensors and LED lights in its products. However, this project also required solution expertise as well as capable components.

The greatest challenge was the bidirectional control of the AGV on the factory floor. Turck suggested a combined RFID contrast strip control. Three strips are drawn on the hall floor; a white one in the middle and a black strip on the left and right. Three fibers with connected fiber amplifiers monitor the strips and measure the degree of brightness. The threshold value is set so that the fiber amplifier can reliably detect the difference between black and white. If the AGV moves centrally on the guide strip, the right fiber sees black, the middle one white and the left one also black. If the

RFID tags that provide the AGV with position information are embedded in the floor at crossings and other key points

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Bert Eilander,
VDL Weweler

contrast strip curves to the right, the right-hand fiber sees white. This notifies the AGV to drive a right-hand curve. The appropriate control signal is sent via the controller to the actuator system of the steering shaft. The AGV thus moves in this way along its "tracks" through the factory halls. As it has to drive forward or backward, steering shafts and controller sensors are installed in duplicate.

RFID system for destination control

Optimum line tracking is combined with RFID tags which are stuck to the factory floor at key points along the lines. The tags at the turnout points indicate to the AGV, whether it is to continue driving or stop. The speed of the AGV is also controlled via these RFID tags. The slow mode is used in curves and for docking in the stations, high speed mode is used for straight sections. High speed in this case means a speed of 1 km/h. Although this is not really fast, it is perfectly satisfactory for the application and is the maximum legally permitted speed for AGVs.

The AGV does not itself make decisions. The intelligence is in the networking of the AGV with the higher-level IMS (integrated manufacturing system), which instructs the AGV to move to a specified point. The logic of the AGV translates the destination to a tag number and checks at each detected tag whether it should stop, slow down or speed up. The controller of the AGV steers and detects by means of an RFID tag when it has reached its destination position. The AGV then puts down the frame and then moves to a set position outside of the cell in order to wait for the next job. If necessary, the IMS instructs the AGV to transport an empty frame back to the production hall.

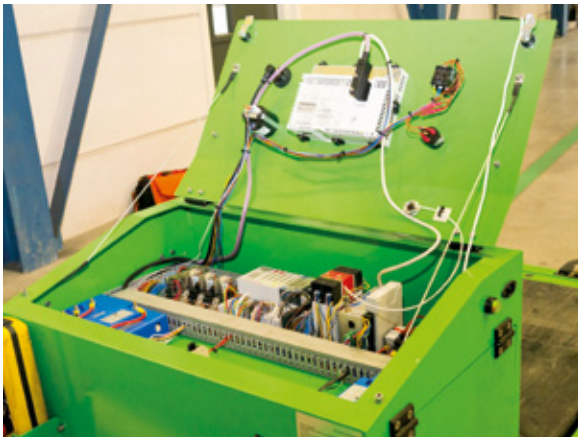
Apart from the IMS only the operators in the control station are able to give orders to the AGV. If the battery is low, they are notified by the SCADA system. They order the AGV to the charging station where they manually replace the flat batteries with a fully charged one.

Turck's VT250 HMI-PLC operates on the AGV. It communicates with the IMS via a wireless TCP/IP connection and responds as a Profibus master with a BL20 gateway containing the inputs and outputs to which all signals of the vehicle are connected.

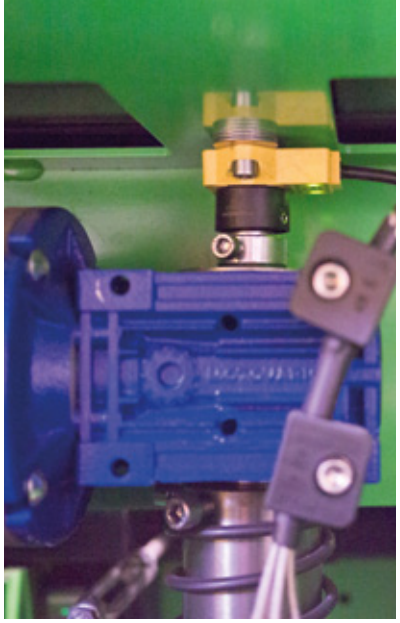
Automation solution single sourced

Movexx utilized the full Turck portfolio when equipping the transport vehicle: Besides the already mentioned fibers and fiber amplifiers from Turck's optical sensor partners Banner Engineering, Turck also supplied its compact and contactless QR14 for measuring the angles on the steering shafts. Optical sensors detect the lifting of the platform, a K50 domed indicator from Banner indicates the operating state, and a laser safety scanner detects whether any objects are present on the section driven by the AGV. Turck's RFID tags, as well as the read/write heads on the vehicle read the position of the AGV.

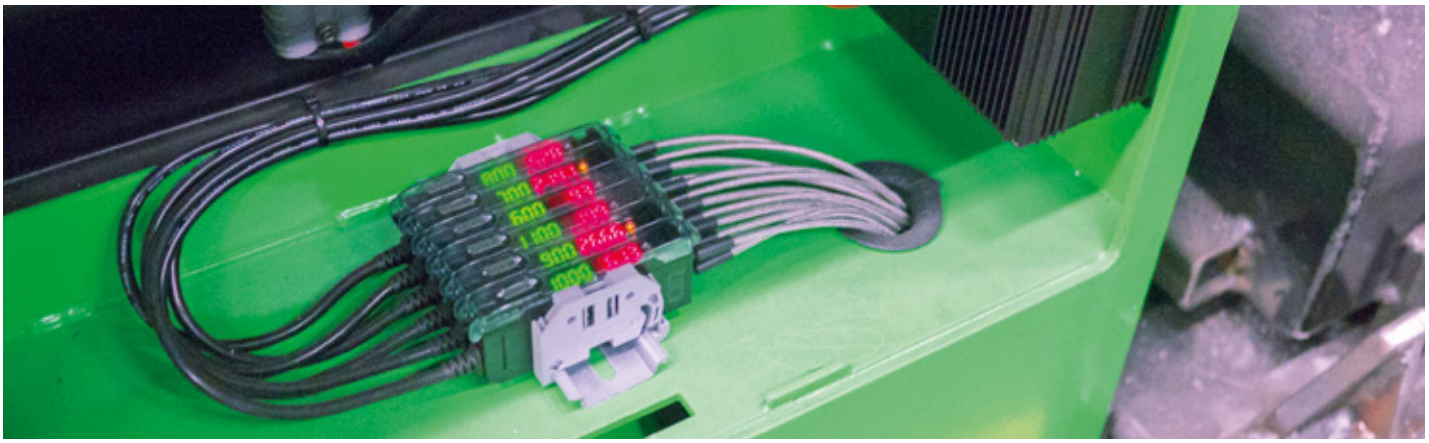
In this project Turck even programmed the controller of the AGV. All the navigation, the processing of



All inclusive: Turck's VT250 is integrated in the cover of the switch box. It communicates wirelessly via Modbus TCP with the IMS and controls virtually all systems of the vehicle



Turck's contactless angle sensor measures the angle of steer at the motor of the steering system



sensor data and the interfaces to other systems including the communication with the higher-level IMS were programmed in Codesys on the VT250.

System supplier benefit

The fact that all products come from one automation supplier makes many things easier – not only for programming but also for Movexx as the customer: "We already had the programmable BL67 and BL20 gateways as a controller for test purposes and were very pleased. We also sent inquiries to other controller suppliers for the project for VDL Weweler. Ultimately, the key factor was the fact that Turck could offer a complete solution for automating the AGV. We therefore chose the Turck solution due to the previous positive experience with them," product manager Versteeg explained his decision and adds: "I also wanted to exclude the risk of suppliers blaming each other in the event of possible faults.

Automation of raw steel supply planned

VDL Weweler also positively rates the automation of the support transport system. Colleagues are reporting that the production manager particularly appreciates the quieter and even production that has been in place since the introduction of the AGV in the middle of 2015. Previously, it was always necessary to stop and make repairs and corrections if a robot could not pick up parts because a hand cart was incorrectly positioned or if other faults led to interruptions.

Due to the positive experience with the solution VDL Weweler is already planning the automation of other transport processes. Another production section is going to be connected, from which components are also to be conveyed to the paint line. In order to process the different parts in individual batches, they must be temporarily stored beforehand, and this is also to be carried out with AGVs.

The supply of raw steel blocks from the stores to the forging furnace is also to be automated with AGVs. This also requires the supplier to be included in the project. VDL Weweler is thus using production processes which look like precursors to Industry 4.0 even if this is not used as the description. The idea that the trucks with trailers provided with VDL Weweler suspension systems are driven fully autonomously sounds like science fiction.

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Three fibers with connected fiber amplifiers are installed for the bidirectional control of each direction