WHITEPAPER

Digital twin in intralogistics - vision and reality

BENEFITS OF THE TWIN FOR PLANNING, CONSTRUCTION AND OPERATION

Unitechnik

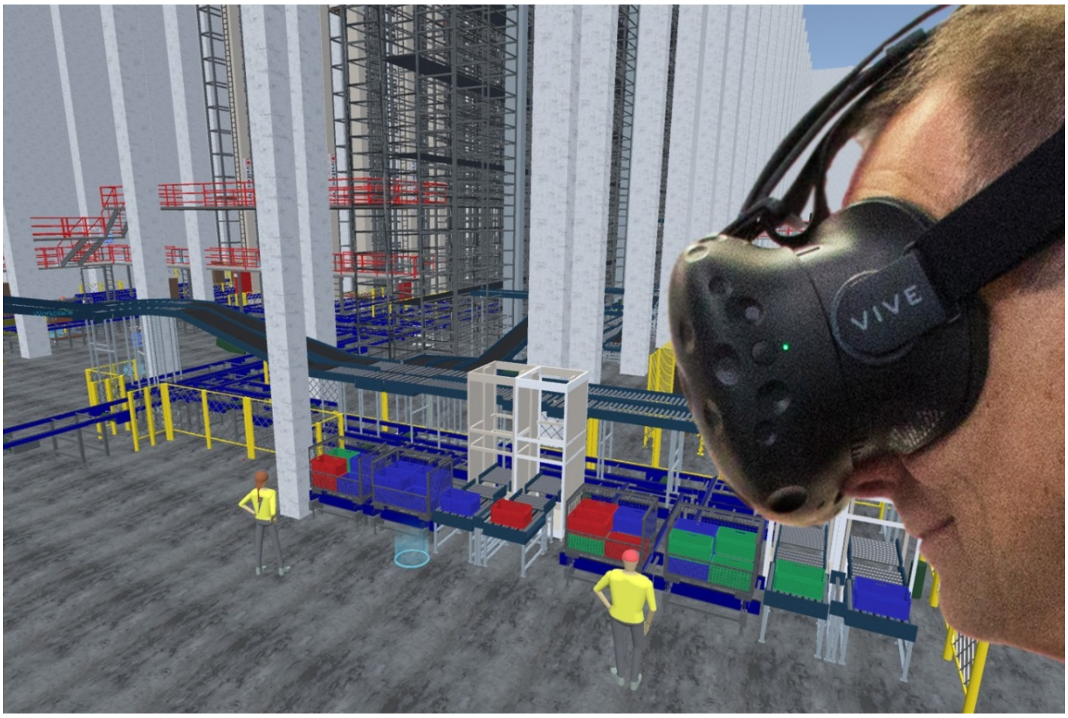
PERFECTION AUTOMATED.

Content

1 Introduction

The performance of a logistics system is defined by the interaction of people, processes and technology. Efficient logistics processes and ergonomic workplaces should therefore be planned just as carefully as the flow of materials. To ensure that the future system optimally meets the customer's requirements, close coordination in the planning and implementation process is the most important prerequisite: the customer is optimally involved in the planning via a digital twin. In order to disturb ongoing operations as little as possible when setting up or converting plants, intralogistics systems can be virtually simulated and tested - here too with the help of a digital twin.

Imagine that a digital twin accompanies the logistics system throughout its entire life cycle - starting with the first planning meeting, continuing with implementation and ending with the operation of the logistics center. An image of the complex facility that looks exactly like the original, reacts in exactly the same way and, once the facility is up and running, maps the current situation in real time. The creation of a comprehensive digital twin for an individual industrial plant is currently not economically viable. But there are already good approaches for individual project phases. Learn more about our vision and the real-life applications of digital twins for an automated intralogistics plant.



The virtual reality model makes it possible for the customer to experience the planned warehouse setup via VR glasses. © Unitechnik Systems

2 Vision: The ideal digital twin

If you were to create a specification for a digital twin of an automated logistics centre, it would probably look like this:

The digital twin allows basic configurations to be created and visualized at the first meeting. This way a visual idea of different variants is created early in the planning process. Once a variant has been selected, the planning and sales process is about refining the solution further and further. The customer can experience his new logistics centre at any time with the help of simulations and virtual reality (VR). The designing process of the workstations is interactive. The operative employees are given the opportunity to virtually test the future workstations while the planning process is still in progress. Their suggestions and ideas reach the planner directly through this involvement. In this way, a maximum of operational know-how flows into the concept.

The throughput of the future plant can be measured in the digital twin. Storage and retrieval machines and conveyor technology set themselves in motion at original speed and work through predefined order scenarios. The customer can watch his system at work via VR. In this way, performance bottlenecks are detected at an early stage and can be eliminated during the planning phase.

In the implementation phase, the digital twin is the central database for all trades. Base plate, steel construction, fire protection, gates, conveyor technology, control technology, warehouse management system, etc. Each project participant works online with the model of the digital twin. If the steel constructor changes his design, this is immediately incorporated into the model and is also visible for the roof and wall cladding trades, for example.

Digital twin In the construction industry: Building Information Modelling (BIM) © WrightStudio - Adobe Stock

The programmers of control technology and warehouse management use the digital twin as an emulator. It behaves exactly like the later plant. This means that the software is fully tested when the plant goes into operation.

During operation, the Digital Twin reflects the exact status of the logistics system in real time, including all sensors, load carriers and stocks. Via VR, it only takes seconds for the maintenance employee to see the faulty plant component and instruct the employees on site.

3 The perspectives of a digital twin

The added value that a digital twin offers all project participants is great. This begs the question why this vision has not yet been implemented.

Other industries are much further along. In the construction industry, for example, there is BIM - Building Information Modelling. Even in highly complex construction projects, all information from different trades flows together here. One explanation for the fact that this approach cannot easily be transferred to complex industrial plants could be that other dimensions play a major role there in addition to the physical structure.

3.1 The physical perspective

The physical perspective represents the geometry of the plant. The 3-dimensional model ideally represents an exact image of the future plant. The customer can get a very good impression through VR-glasses. The model also reveals collisions between the different trades, such as the support of a platform that is in the way of the conveyor system. The individual elements can be given properties or additional information. The BIM described above almost exclusively serves this physical perspective.

3.2 The functional perspective

The functional perspective covers the dynamic properties. Speeds and accelerations of all conveyor elements. The switching behaviour of sensors, the behaviour of machines, the entire material flow, the storage logic, the picking processes and much more.

3.3 The operational perspective

The operational perspective includes the operational aspects. Questions that are illustrated here are: When will which goods be delivered or shipped? What does the typical order structure look like? Which working hours are stored for the employees? How many picks are made per order? What is the storage range? How extensive is the product range?

3.4 The real-time perspective

The three perspectives mentioned above can be incorporated into a model at any stage of a project. The real-time perspective requires the operation of the real plant. Each load carrier is located in the model in exactly the same position as in the real logistics facility. Each sensor has the same switching state. Movements and inventories are an exact copy of reality. Additional sensors (temperature, sound, vibrations, etc.) reflect the current state of machine parts.