Product report: Sequencing at shop floor level with Qualicision

Scheduling for intelligent production

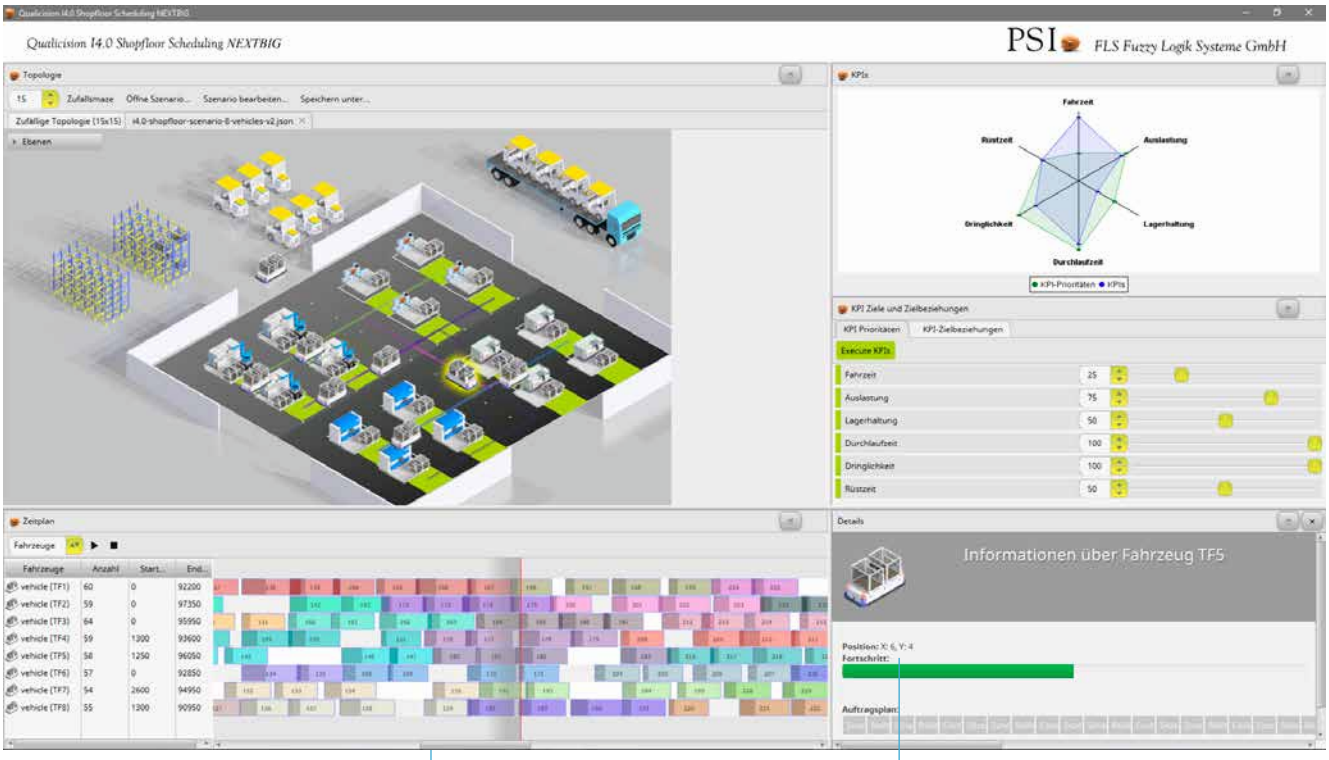
Heading into the fourth industrial age, the face of production sites is increasingly changing. Thanks to the proceeding connectivity of IT, machines and people, productions can be made more flexible and mobile, e.g. by automated guided vehicle systems in the sense of an Industry 4.0 swarm production. In addition, self-organising production structures at shop floor level can be established based on information and material flows, without the need to simultaneously neglect the variety of key performance indicators (KPIs) and the resulting interactions between possibilities for managing production processes.

Conceptual research projects on the road to an intelligent production, in which processes become self-regulating and highly flexible in planning and control by cyber-physical systems, result in software solutions such as Qualicision I4.0 Scheduling from PSI FLS Fuzzy Logik Systeme GmbH which already assists the visualisation of order sequences at shop floor level in production planning and control. The software optimises and visualises production orders, the utilisation of the individual manufacturing cells, and the automated guided vehicle systems that move between stations and storage areas controlled by KPIs (see figure).

Optimising production process in real time

Qualicision I4.0 Scheduling enables users to optimise the production process in real time. In addition, even before the start of production they can use simulations to calculate estimates at which time which settings of the KPI inputs are required so that the planned orders can be produced in a timely manner while simultaneously the KPI goals are optimally achieved through the production process, i.e. taking into account the KPI goal conflicts. The scheduling combines proven methods of sequencing which determine the sequences based on order characteristics or planned times per station, by usage of flexible resources such as automated guided vehicle systems in the sense of an Industry 4.0 swarm production as well as characteristics of the production stations at the KPI-oriented planning and control of production orders.

The application is configured using the priority graph for the products



Qualicision I4.0 Scheduling enables the user to optimise the production process in real time.

to be manufactured. This provides a technical map of all relevant operations required to manufacture the respective products with their predecessor and successor relations. For example, it shows that the wiring harness in a car is forcibly first laid and then the interior trim panels of the components.

However, if there are degrees of freedom in terms of the sequence of operations, it is possible to perform a real-time situational calculation of which station conducts which operation and in what sequence. For example, for two production stations which could perform the same operation at the same time for two different orders a qualified decision can be made which sequences are closer to the KPI production goals. Examples of such KPI goals are minimising order lead time while simultaneously maximising capacity utilisation of the entire shop floor.

Conflict and compatibility analysis

To analyse the sequences generated at shop floor level the conflict and compatibility analysis from Qualicision is used. The analysis is calculated by using a real time, self-organising KPI goal relations matrix and controls the scheduler. Their visualisation creates transparency in processes by indicating which optimisation input requirements are in conflict with one another and thus can be met gradually and intensively. The user can adjust the optimisation settings through the integrated slider in the scheduler. On the basis of Qualicision's KPI-oriented optimisation model goal conflicts are accordingly optimally balanced by using flexible resources. Thus savings of up to 15 percent can be achieved, compared to conventional optimisations in comparable applications, e.g. based on weighted sums.

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