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TIMELY REQUEST OF DRIVERLESS TRANSPORT VEHICLES IN A MODULAR ASSEMBLY SYSTEM

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Technical task:
In a modular assembly environment, assembly stations are arranged in the room without direct linkage. The sequence of these stations is determined by a work plan.
The transport between these stations takes place for example with a driverless transport system, the control is fully automatic. In the process, travel orders are generated which are used to pick up an component from a station and deliver it to the next station. If the resources of transport vehicles are limited, the transport orders must be prioritized. In particular, it makes sense to ensure short vehicle journeys so that as few vehicle resources as possible are used for each order.

Initial situation:
One approach is to evaluate the costs of the journey. Such a procedure has the disadvantage, however, that order journeys with high costs, which do not result from the temporary spatial situation of the vehicle, but from the distance of the assembly station, are possibly delayed or not at all executed. Such orders can be given higher priority over time, so that the cost approach only becomes important in the second instance. In the meantime, this has possibly already led to a time delay in the pickup and thus stopped the production process.

Solution:
Another procedure lists all jobs created in the chronological order of the deceleration time (time - absolute) of the component (or workpiece carrier on which the component is located) minus the average travel time to this pickup position. This sequence determines the sequence in which the jobs must be processed. This procedure means that even distant machines can be operated at any time.
Such a table could look like this:

Machine	Workpiece carrier	Job	Deceleration time of workpiece carrier	Deceleration time - ⌀ acceleration time
2060	1014	J12345	10:34:23	10:33:23
2050	1008	J12346	10:34:58	10:32:28
2020	1003	J12347	10:35:32	10:34:32
2050	1018	J12348	10:35:45	10:33:15
2090	1019	J12349	10:36:02	10:35:02

…

Due to the influence of the acceleration time, the jobs in the table must be re-sorted:

Machine	Workpiece carrier	Job	Deceleration time of workpiece carrier	Deceleration time - ⌀ acceleration time
2050	1008	J12346	10:34:58	10:32:28
2050	1018	J12348	10:35:45	10:33:15
2060	1014	J12345	10:34:23	10:33:23
2020	1003	J12347	10:35:32	10:34:32
2090	1019	J12349	10:36:02	10:35:02
…				

In this case, the second job on the assembly station 2050 has slipped up in the table because the journey time to this station is longer than to the others.
If there are currently only 3 transport vehicles available for processing the jobs, the top three jobs are selected. These jobs are set to the status Processing, removed from the table. The three transport vehicles are directly assigned to the jobs. The selection of the suitable transport vehicles is made again according to the shortest journey time (costs).
The deceleration time of the workpiece carrier is calculated from its current position and the normal expectation in which this workpiece carrier is ready for collection during normal processing.

Advantages:
In contrast to the procedure described in the initial situation, it is guaranteed that all travel orders are processed as punctually as possible (depending on the availability of the vehicles).