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DRIVERLESS TRANSPORT SYSTEM WITH THE POSSIBILITY TO STOP PARKING JOBS IN A CONTROLLED WAY

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Technical task:
The task of the system is able to stop the jobs of a driverless transport system in a controlled manner if necessary.

Initial situation:
In a driverless transport system in which the transport orders are largely non-deterministically assigned, as in a modular assembly system, for example, situations can arise in which a transport order is completed and a follow-up order for the vehicle does not yet exist. To ensure that all transport orders are processed, it is necessary to have sufficient vehicles available in such a system. This can result in all vehicles being occupied with orders or individual vehicles also having idle time. If these vehicles stop at their last destination, they block this waypoint for a subsequent vehicle that also executes an order for this destination. If the blocking vehicle does not start again until it has received a follow-up order, the following vehicle would be blocked for this period. This in turn blocks a follow-on order and so on, so that the system can even come to a standstill for this period. This has a corresponding negative effect on the output of the system. One way to resolve this conflict is to give the blocking vehicle without a driving job a so-called parking job, i.e. "drive from your last destination to a parking space in the immediate vicinity". The vehicle would then no longer block the last destination, drive to this car park and wait there for the next driving job. Since such a system is highly non-deterministic, it can happen that a new driving job is available immediately after the parking job has started. The vehicle would then continue to its parking space and then execute the new driving job. If more than one vehicle performs such a parking job, the vehicle that arrived at its parking space first would accept the new driving job. Another possibility is to optimize the arrival times of several such vehicles at their parking spaces and the distance of the parking spaces to the new destination. The time taken to complete the parking jobs will always be a lost time.

Solution:
The aim is to create a possibility to break off parking jobs in a controlled and sensible way. For this purpose, it is assumed that there is a finite number of vehicles (or even only one) on the way to a parking lot. Furthermore, it is assumed that the new destination for these vehicles is not on the way to their parking place, so that the route to be taken changes. If a new driving job now arises, the current position must be determined for all these vehicles. The decisive factor here is how far the vehicle is from an intersection where an alternative route could be taken if necessary to the new destination. In this case, it must also be considered whether the vehicle can still brake in time within the reaction time of the calculation. If this is not the case, the next waypoint behind the intersection on the actual route to the parking lot must be accepted. If these positions are now known, the system determines which of these vehicles has the shortest route to the destination of the new driving job. The latter cancels its parking job and receives the order to drive to the new destination. All other vehicles keep the route to their parking place. Alternatively, a limited number of several vehicles could drive to the new destination and the "losers" then start a new route to a parking lot. This would have the advantage that if one selected vehicle is to be stopped on its way to the new destination by some circumstance along the way, another could carry out the order in a timely manner.
Furthermore, not only the vehicles that are currently on their way to a parking lot are considered, but also those that are already in a parking lot and those that are currently executing an active driving job but are in the immediate vicinity of the new destination. In addition to aborting such parking jobs, active driving jobs whose destination is currently unreachable can also be aborted according to the same principle. If a vehicle is to pick something up at a destination, but this destination is still occupied because several vehicles have been sent to this destination at the same time, and if the vehicle already at the destination cannot leave immediately, the transport job for the following vehicle is cancelled and it offers its service for other jobs. Another possibility would be to reduce the parking to those vehicles that are actually hindering the approach to the destination. If this is not the case, the vehicle can wait there for its next order.

Advantages:
Vehicles without a driving job immediately leave their last destination point and do not block it for a subsequent job. If a new transport order is generated, it is possible to react immediately by selecting the correct vehicle that can carry out this job.