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Background information

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Transforming public transit with demand-responsive autonomous shuttle bus systems

The world of mobility is a prime example of disruptive transformation – a transformation that is driven by four key trends: electrification, connectivity, shared use and autonomous technology, with autonomy being the lever that is expected to have the biggest impact. In the future, self-driving vehicles will fundamentally change the ways of how we move about.

Demand-responsive mobility solutions based on bus shuttle systems

Providing an adequate range of sustainable mobility options is a key responsibility of cities and municipalities. Strengthened and expanded public transport offerings are essential when it comes to serving the growing mobility demands in densely populated urban centers.

Traditional mass transit systems such as regional trains, metro networks, rapid-transit and light rail systems as well as trams will continue to be the main means for transporting large numbers of passengers safely and efficiently over relatively long distances. For providing optimum connections, bus shuttle systems can be deployed to cover the so-called last mile between the railway station and the passenger's final destination. This will help reduce the volume of private transport, substantially relieving the strain on the urban street network and lowering the stress level of the people living in the city. Other benefits include a significant reduction of the CO_2 emissions and a higher quality of life.

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The concept: close interaction between vehicles, intelligent infrastructure and a dedicated software platform

The central purpose of the envisaged system is to allow the safe and efficient operation of bus shuttles in street traffic – using driverless technology on autonomy level 5, i.e. the maximum level defined for road vehicles. To enable this kind of system, the intelligent infrastructure of Siemens Mobility provides the vehicles continuously with safety-critical information, for instance on the current traffic situation and on other road users present on the intended route. This approach supports autonomous vehicles especially in navigating complex traffic situations and in difficult-to-monitor areas, where the sensors in vehicle itself cannot capture the relevant data, possibly also due to current weather conditions. Such external support significantly expands the monitored operating radius of a self-driving vehicle. Communication with the intelligent road infrastructure enables vehicles to quickly identify potential risks and respond accordingly. What is more, the integrated system helps improve the flow of traffic. The vehicle-to-infrastructure communication (V2I) uses the standardized and extensively tested WLANp technology (ITS-G5).

The system is rounded out by software solutions that enable traffic managers in the traffic control center to closely monitor the individual vehicles and the overall traffic situation and intervene whenever necessary. An additional valuable tool is the wide range of simulation solutions that deliver a better understanding of traffic processes and individual driving behavior as the basis for deriving effective measures and interventions. Step by step, the city and its various levels of operation are mirrored in a Digital Twin, which generates relevant insights in real time that can be immediately translated into improvement measures for the entire system.
The passengers of the autonomous vehicles can plan and monitor their intermodal travel route via an easy-to-use app that already integrates the existing public transport services.

All these measures will contribute to a substantial increase of safety and efficiency on the road.

Autonomous HEAT shuttle bus in Hamburg

Since August 2019, an autonomous shuttle bus has been making its rounds in Hamburg – in the scope of HEAT (Hamburg Electric Autonomous Transportation), Germany’s unique research and development project for investigating the integration of an autonomous shuttle bus in normal road traffic. Five meters long and weighing just under three metric tons, the electric-powered minibus can travel at a speed of up to 35 miles/h and will be transporting up to ten passengers through Hamburg's HafenCity as of mid-2020. For Hamburg, the project is an important showcase for the 2021 ITS World Congress scheduled to take place in this North-German city.

A key feature of the HEAT project is its step-by-step approach. In the first phase, starting with the test operations, the minibus will run along a defined route, without passengers but accompanied by a professional vehicle attendant able to immediately take control if necessary. The objective of the project is to investigate all aspects of such a set-up and prove that self-driving minibuses can be fully integrated into street traffic and a city's public transport system. The HEAT minibus is tested in real-life conditions on public streets. Autonomous operation is scheduled to start in time for the World Congress. The contribution of Siemens Mobility consists in the intelligent infrastructure deployed along the route as well as the control center software and the simulation solutions needed for validation and verification of the system.

Activities in Singapore

For many years already Singapore has been one of the world's pioneers in deploying innovative mobility solutions. Also when it comes to using autonomous bus shuttles as part of the public transport network, the city-state in Southeast Asia is living up to this reputation. This important step towards the future of mobility is of national importance in view of the persistent challenges that the island-state has to master: scarcity of land surface and the rising mobility demands of a continually growing population. Since 2017 Singapore's Land Transport Authority (LTA) and its partner Nanyang Technical University (NTU) have been operating the CETRAN test track on the outskirts of the city, where manufacturers can test their vehicles under real-life conditions. The facility is also suitable for vehicle acceptance tests. Siemens Mobility has equipped part of the track with intelligent infrastructure and created a Digital Twin of the facility. The latter makes it possible to simulate vehicle behavior in a wide range of critical traffic scenarios before sending the vehicle, modified on the basis of the insights derived from the simulation, along the track for the "real" test.

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