

Bosch presents tomorrow's mobility today Debut of new concept shuttle at CES 2019 in Las Vegas

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- ▶ Bosch management board member Dr. Markus Heyn: "In the future, every vehicle on the road will make use of Bosch digital services."
- ▶ The Bosch ecosystem of mobility services makes shuttle mobility flexible and suitable for everyday use.
- ▶ Bosch is developing systems and components for automating, connecting, and electrifying shuttles.

Stuttgart, Germany – A light, airy, minimalistic design, a futuristic outer shell made of display screens and glass, and a spacious interior – that is how architects might describe a novel structure, but in actuality the description also fits a completely new class of vehicle and a new kind of mobility: driverless electric shuttles that glide almost silently through city centers and are seamlessly connected with their environment. These will soon be a common sight on our city streets – whether they are transporting goods or people. Bosch provides components and systems for automating, connecting, and electrifying the shuttles, but shuttle mobility won't be possible without mobility services. In the future, the company will offer these services too, bundling them into a smart, seamlessly connected ecosystem. That will include booking, sharing, and networking platforms, parking and charging services, and software solutions for managing and maintaining the vehicles, as well as infotainment during the journey. "Bosch is developing a unique package of hardware, software, and mobility services for shuttle mobility of the future," says Dr. Markus Heyn, member of the board of management of Robert Bosch GmbH. At CES 2019 in Las Vegas, the world's biggest electronics show, Bosch will be presenting its solutions for this area of transportation with a concept shuttle, and visitors will be able to experience its full range of services.

Bosch services for users and shuttle operators

The emergence of the shuttle segment is a result of rising demand for ridesharing services: in Europe, the U.S., and China alone, about one million such on-demand shuttle buses will be on the roads as early as the year 2020, growing to 2.5 million by 2025 (source: Roland Berger). Many of these vehicles, available 24/7, will be fully electric, and they will also be completely autonomous by the middle of the next decade at the latest. That's why Bosch has packed every square centimeter of its concept shuttle with the appropriate technology – from electric powertrains and 360-degree surround sensors to connectivity management and vehicle computers. Yet these components and systems go only part of the way towards shuttle mobility. To make on-demand vehicles suitable for flexible everyday use, they must be connected to mobility

services. “In the future, every vehicle on the road will make use of Bosch digital services,” Heyn says. These services allow users to book the vehicles, share rides with other passengers, and pay for the journey. Charging, repairing, and maintaining the vehicles, plus route planning and administrative activities, also call for services that Bosch will offer shuttle fleet operators in a seamlessly connected ecosystem.

Booking and sharing

Users can easily book a shuttle via smartphone, regardless of whether they’re relaxing on the sofa or sitting at their desk at work. Working behind the scenes, an algorithm identifies the vehicle closest to the requested location and finds other users who wish to travel a similar route. The more passengers a single shuttle can transport, the cheaper the journey for everyone. This approach also reduces the amount of traffic in cities and mitigates the impact on the environment. Bosch is developing the necessary software platforms to make this a reality. When the shuttle pulls up to the requested pick-up point, users again use their smartphones to identify themselves – thanks to Bosch’s Perfectly Keyless digital access service. It recognizes the owner’s smartphone as unmistakably as a digital fingerprint and opens the vehicle only for them. Every passenger always gets the seat that they reserved.

Moving forward: electrified and automated

Bosch’s electric axle drive makes the shuttles especially efficient yet affordable as they wend their way through the city. And the company’s Convenience Charging service knows just how long the battery charge will last and where to recharge the vehicle. This service means that even today, drivers no longer need to worry about being stranded with a dead battery. It also links vehicle information, such as the current state of battery charge or how much energy the heating and air-conditioning systems are consuming, with environmental data such as congestion and weather forecasts, so as to predict vehicle range with particular accuracy. Furthermore, Convenience Charging finds the ideal charging station and can reserve it in advance. And thanks to a standardized access and payment system, charging is easier than ever.

Driverless e-shuttles provide users with transportation that is not only nearly emissions-free, but also very safe. For automation, Bosch develops and makes its own radar, video, and ultrasonic sensors, braking control systems, and power steering, to name a few examples. Smart digital services are indispensable here, too: Bosch predictive road-condition services let automated vehicles know in advance what environmental conditions to expect. They can thus adapt their driving style as needed so as to ensure maximum safety throughout the journey. The Bosch road signature is a map-based localization service with which automated vehicles can accurately determine their position in the lane down to a few centimeters – another crucial prerequisite for the safety of automated shuttles.

Comfortable interior

Bosch has designed the interior of its concept vehicle to provide space for four passengers, seating them across from one another to maximize legroom and comfort. Infotainment is provided on screens that can be used either by each passenger individually or in groups; for example, a family can watch a movie together as they travel somewhere for the weekend, or colleagues can work on a presentation on their way to the office. Smartphones use the on-board Wi-Fi and can integrate seamlessly with the infotainment system, thanks to Bosch connectivity technology. Its concierge service turns the shuttle into a personal assistant. With all kinds of information at its disposal, the shuttle can provide passengers with recommendations, advance bookings,

weather reports, and travel tips at any time. Once the shuttle has arrived at its destination, the passengers can pay for their journey with Bosch's e-payment service.

Maintenance and administrative activities

But Bosch services do not end when a rideshare journey is over: the company's camera-based system for the vehicle interior checks whether anyone has forgotten their phone or handbag. If a passenger does forget something, the shuttle informs them directly via smartphone. The cameras can also detect gum on the seat or an overturned coffee cup – in other words, whether the shuttle needs cleaning – and can make the necessary arrangements immediately. This is so every passenger can start their journey in a clean shuttle. Bosch's service for over-the-air updates can determine whether the driverless shuttles have the latest software version. The service detects software updates as soon as they are available and executes them in the vehicle securely and reliably. Thanks to sensors installed in the vehicle, predictive diagnostics can monitor the condition of key components and notify the shuttle before a fault actually occurs, so it has enough time to drive itself to a repair shop. This prevents the car from suddenly breaking down, which is a boon to operators. In the future, Bosch will pool updates from the data cloud and predictive diagnostics into a comprehensive connectivity platform. This will give vehicle manufacturers and shuttle service operators a constant overview of the condition of their fleets, so they can ensure that their shuttles are always ready for action. And finally, the Bosch subsidiary ESCRYPT's security solutions handle vehicle security – whether for keyless access systems, data connectivity with the outside world, or software updates.

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Bosch at CES 2019

- **PRESS CONFERENCE:** In Ballrooms B, C, and D, Mandalay Bay Hotel, Las

Vegas **South Convention Center, Level 2**, from **9:00 to 9:45 a.m. local time on Monday, January 7, 2019**

- **BOOTH: Tuesday to Friday, January 8–11, 2019**, in the Central Hall, booth #14020

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Mobility Solutions is the largest Bosch Group business sector. According to preliminary figures, in 2017, its sales came to 47.4 billion euros, or 61 percent of total group sales. This makes the Bosch Group one of the leading automotive suppliers. The Mobility Solutions business sector pursues a vision of mobility that is accident-free, emissions-free, and stress-free, and combines the group's expertise in the domains of automation, electrification, and connectivity. For its customers, the outcome is integrated mobility solutions. Its main areas of activity are Injection technology and powertrain peripherals for internal-combustion engines, diverse solutions for powertrain electrification, vehicle safety systems, driver-assistance and automated functions, technology for user-friendly infotainment as well as vehicle-to-vehicle and vehicle-to-infrastructure communication, repair-shop concepts, and technology and services for the automotive aftermarket. Bosch has been responsible for important automotive innovations, such as electronic engine management, the ESP® anti-skid system, and common-rail diesel technology.

The Bosch Group is a leading global supplier of technology and services. It employs roughly 402,000 associates worldwide (as of December 31, 2017). The company generated sales of 78.1 billion euros in 2017. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected manufacturing. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group's strategic objective is to deliver innovations for a connected life. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is "Invented for life." The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiary and regional companies in 60 countries. Including sales and service partners, Bosch's global manufacturing, engineering, and sales network covers nearly every country in the world. The basis for the company's future growth is its innovative strength. At 125 locations across the globe, Bosch employs some 64,500 associates in research and development.

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