CAN Newsletter Online

ROBOTIC CAR

Micro car for mega cities

Researchers of the University of Bremen have developed a small robotic car that aims to help with congested traffic in cities. The car can drive diagonally and turn on the spot.

More and more people are drawn into the big cities of the world. Consequently, all of these cities have one challenge to face: Not enough parking space and very congested traffic, especially during rush hour. This becomes even more problematic when big cars are used by single individuals. Therefore, small and safe cars are required. In addition, the electric drive train provides possibilities to completely rethink what we know about individual transportation.

Front view of the car (Photo: Timo Birnschein, DFKI)

The EO smart connecting car 2 is the result of ongoing research, development, and optimization of the EO smart connecting car concept. Like its predecessor, it offers normal driving, but also driving diagonal, turning on the spot, and even driving sideways. The car has shrunk from 2,6 m down to 1,8 m, while maintaining a comfortable seating position and weighs only 750 kg. It reaches only 65 km/h, which is sufficient for driving in cities.

It is possible to shrink the car by almost a meter in length and to autonomously dock at charging stations. It was created as a test platform for the development of complex autonomous functions. Its modular design offers a number of different applications in several domains, such as public and private transportation, logistics, and more.

One problematic aspect of electric vehicles is the charging cable though. To face this issue, a foldable docking interface was constructed that fits into the body of the car and also allows connecting extension modules, like range extenders, passenger modules, or cargo modules. For in-vehicle communication, the mini car employs CAN, EIA-232, EIA-485, and LAN.

Folded car with drive sideways mode (Photo: Timo Birnschein, DFKI)

In a paper on the first version of the mini car, the developers describe the CAN communication of the car: DFKI developed H-bridges for the implementation of control tasks of each of the linear motors. The H-bridges of each axle are connected with the motor controller board and the control PC directly via CAN.

Furthermore, "each drive element is connected independently to the vehicle’s central control unit. Within each single drive element, every active unit is controlled by a dedicated controller board. This is a controller for each of the four linear actor elements handling the wheel's position and orientation, plus one controller driving the wheel motor. These controllers use the CAN bus protocol for communication, all controllers of a single drive element form a CAN device using a certain address space. [...| Two of these logical devices – corresponding to two drive elements – form one of the vehicle's axes and are connected to the central control unit using a single, dedicated CAN bus line." With this architecture, two or more vehicles that are coupled together are not be understood as two (or more) vehicles anymore. With this control concept, they can be operated as a singe vehicle entity.

Big windows give a good perception of the surrounding environment while an intuitive user interface provides access to all drive modes the robotic car has to offer. The car’s computer and its auto-navigation system provide driver assistance functions: autonomous parking, even on narrow and congested roads, is possible. In the future, an autopilot is supposed to drive the car without a single passenger intervention, creating the driverless car.

Designing a possible future of mobility

A team of nine engineers, a designer, as well as several students of the German Research Center for Artificial Intelligence at the University of Bremen created the robotic car between October 2011 and July 2014. Partners are H^2O e-mobility and Fraunhofer IFAM. The project is sponsored by the German Federal Ministry of Transport, Building, and Urban Development.

To prove the feasibility of the technical requirements, an integration study as well as a detailed physics simulation model was built. Both utilized the final axial modules and most of the final electronic components. After successful tests, a chassis was constructed and built. At the same time, software development was underway for integrated, dedicated, and custom-built vehicle control units.

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