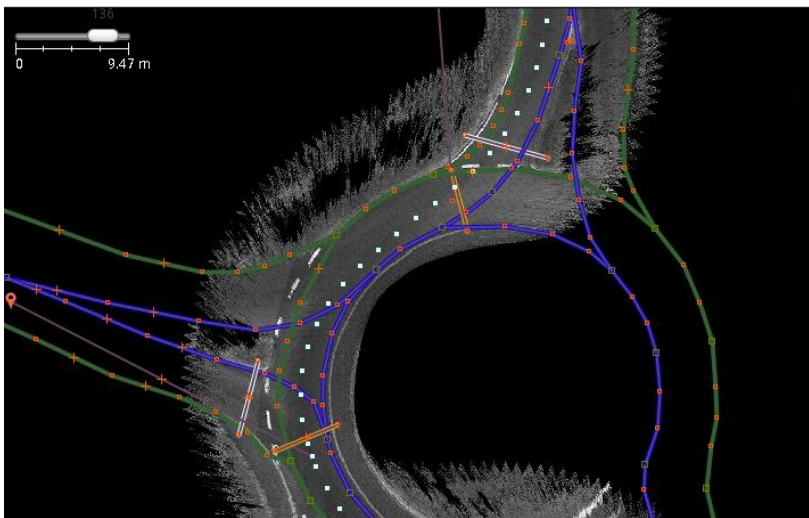


## Fully Automatic – Following the Tracks of Bertha Benz

Computer-controlled Vehicle Developed by Daimler AG with the Help of Scientists from FZI and KIT on the Historical Route between Mannheim and Pforzheim



With the help of a detailed digital map, the vehicle can automatically drive through roundabouts. (Photo: Julius Ziegler)

A joint project of researchers from the Research Center for Information Technology (FZI), Karlsruhe Institute of Technology (KIT), and Daimler AG focuses on the development of intelligent vehicles that increase traffic safety. Using video-based positioning and navigation systems as well as intelligent sensors, the Mercedes-Benz S 500 INTELLIGENT DRIVE pulls out automatically into flowing traffic, reliably passes crossings, and recognizes obstacles. Functioning of the system has been demonstrated by the partners on a special route: The autonomous vehicle covered the same way that was chosen by Bertha Benz for the first historical long-distance drive 125 years ago. Daimler presents the vehicle at the IAA International Motor Show in Frankfurt this week.

The vehicle autonomously covered the route of about 100 km on federal and state roads through 24 cities and municipalities from Mannheim to Pforzheim. For this purpose, the Mercedes-Benz S model had been equipped with the necessary technology by Daimler AG in cooperation with KIT and FZI.

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The sensor technology via which the vehicle perceives its environment was developed by Daimler. Similar systems are already available in the new E and S class models. For the vehicle to react to the data supplied by its sensors, processes were developed by Daimler in cooperation with the team of Professor Christoph Stiller from the KIT Institute of Measurement and Control and FZI. Development of these processes mainly focused on calculating how the vehicle is to behave in traffic (behavior generation) and to choose the optimum route (trajectory planning). "Based on the sensor data, the system determines the steering wheel angle, accelerations, and decelerations, that is where and how quick the vehicle is to drive," Stiller says. According to him, the vehicle can drive through roundabouts and crossings, pull out into flowing traffic, recognize other traffic participants and traffic lights, and drive around obstacles. "In this research project, we demonstrated that highly automatic driving is possible with simple video sensors. Assistance functions to increase driving safety and environmental compatibility will be integrated in series vehicles soon," Stiller adds.

For the drive on the route once chosen by Bertha Benz, Stiller and his team as well as Daimler also analyzed the contents of the novel digital maps required. These maps are comparable with the maps used for today's navigation systems, but much more detailed. "These maps contain information that cannot or can hardly be determined by the vehicle during the drive, such as the location of driving corridors in the crossing area, the position of traffic lights or right-of-way rules," Julius Ziegler explains. He is the Head of the project at FZI and coordinates it together with Christoph Stiller. The vehicle has to determine its position very precisely at any time. "For conventional navigation systems, satellite-based GPS with an accuracy of some meters is sufficient. For our project, however, positioning with centimeter accuracy was necessary," Ziegler emphasizes. The scientists apply a video-based positioning method. With a specially equipped vehicle, a mapping drive is made. This means that the camera data are used to generate a visual model of the route and its surroundings. Later on, the automatic vehicle compares the picture recorded by its camera

with this model and can determine its location very accurately.

Since June 2012, the project partners have made their autonomous vehicle cover a distance of more than 6500 km on public roads. During these test drives, two drivers were sitting in the vehicle for interference, if necessary. The test drives were hardly noticed by the public, as the research vehicle presented by Daimler at this year's IAA cannot be distinguished from a series model. Earlier test drives

were also carried out with the autonomous vehicle “AnnieWAY” developed by KIT’s Institute of Measurement and Control. In the past years, this vehicle was successful in international competitions. It won the Grand Cooperative Driving Challenge in 2011 and was in the final of the 2007 Urban Challenge.

### **About the FZI Research Center for Information Technology**

The FZI Research Center for Information Technology at Karlsruhe Institute of Technology is a non-profit institution for applied research and technology transfer in computer science. It provides companies and public institutions with latest research findings in information technology and qualifies young people for careers in academics, business or self-employment. Led by professors from different departments, research teams at FZI interdisciplinarily develop concepts, software, hardware, and systems solutions for their clients, which are then translated into prototypes. The FZI House of Living Labs is a unique research environment for applied research. Every FZI department is certified according to DIN EN ISO 9001:2008. Sectors working on applied research for medical projects are also certified according to DIN EN ISO 13485:2010. The main office is located in Karlsruhe, a branch office of FZI can be found in Berlin.

**Karlsruhe Institute of Technology (KIT) is a public corporation according to the legislation of the state of Baden-Württemberg. It fulfills the mission of a university and the mission of a national research center of the Helmholtz Association. Research activities focus on energy, the natural and built environment as well as on society and technology and cover the whole range extending from fundamental aspects to application. With about 9000 employees, including nearly 6000 staff members in the science and education sector, and 24000 students, KIT is one of the biggest research and education institutions in Europe. Work of KIT is based on the knowledge triangle of research, teaching, and innovation.**

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