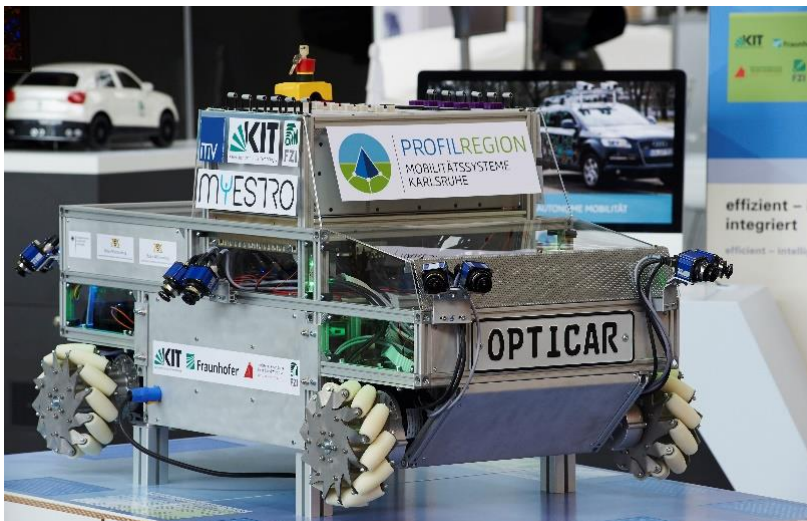


## Autonomous Driving: Permanent Environmental Recognition

Reliable Environmental Recognition Is Crucial to Autonomous Driving – OPTICAR Project Develops and Optimizes Camera Systems for the Karlsruhe Priority Region for Mobility Systems



The "OPTICAR" vehicle is used to test new environmental recognition methods for autonomous driving. (Photo: KIT)

Autonomous vehicles are important elements of new mobility systems. For these vehicles to act autonomously and safely in traffic, they must be able to exactly recognize their environment. Within the framework of the "OPTICAR" project, experts of Karlsruhe Institute of Technology (KIT), FZI Research Center for Information Technology at the Karlsruhe Institute of Technology, and MYESTRO Interactive GmbH have developed a research and test platform for stereo camera systems. The collaborative project is aimed at making these systems more precise and robust.

"Exact recognition of the traffic situation around a car is the prerequisite for the successful use of autonomous vehicles," Matthias Pfriem, Manager of the "Karlsruhe Priority Region for Mobility Systems" cluster and scientist of KIT's Institute of Vehicle System Technology, says. Apart from lidars, radars, and ultrasonic systems, also wide-angle stereo cameras can be used for an autonomous vehicle to recognize its own position and that of objects in its environment. This is required for the precise execution of driving maneuvers, such as overtaking or lane changes.



KIT Mobility Systems Center:  
Solutions for tomorrow's mobility

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Images recorded by stereo cameras allow for a depth perception of the environment comparable to spatial vision by a pair of eyes. They provide information about the position, distance, and speed of objects. Together with their industry partner MYESTRO, scientists of KIT and the FZI Research Center for Information Technology at the Karlsruhe Institute of Technology developed a demonstrator vehicle scaled 1:4 that is equipped with six of such camera pairs all around. These cameras cannot only measure the closer environment. Virtual interconnection of cameras from different camera pairs increases the distance of the cameras up to the total vehicle width or length. Hence, also objects located further away can be recognized precisely. As a result, depth maps of the environment can be produced.

The stereo cameras transmit their data via Ethernet to an embedded, high-performance image processing computer that continuously generates an overall picture of the traffic situation in the environment in real time. A special challenge consists in the vibrations of the vehicle body during operation. These vibrations change the orientation of the cameras towards each other and make the determination of useful image information more difficult. The "RubberStereo™ technology" developed by MYESTRO directly recognizes and compensates these vibrations in real time by comparing the image data of the camera pair.

The OPTICAR vehicle is planned to be used for testing new technologies and to serve as a demonstrator in academic education. Thanks to its open design, the test vehicle can also be extended by additional modules, such as radars, maps, or Car2X communication depending on the research problems analyzed.

"OPTICAR" is part of the topic "Automated and autonomous mobility" of the Karlsruhe Priority Region for Mobility Systems (Profilregion Mobilitätssystem Karlsruhe). This cluster funded by the state of Baden-Württemberg and the Fraunhofer Society connects regional partners in the area of mobility research. Apart from 19 chairs of KIT, four Fraunhofer institutes, the Fraunhofer project group for new drive systems (NAS), Karlsruhe University of Applied Sciences, and the FZI Research Center for Information Technology at the Karlsruhe Institute of Technology participate. Partners of large and medium-sized enterprises are integrated as well to ensure close cooperation between science and industry.

More information can be found at <http://www.profilregion-ka.de> (in German only).

**More about the KIT Mobility Systems Center**  
<http://www.kit.edu/research/6720.php>

**Karlsruhe Institute of Technology (KIT) pools its three core tasks of research, higher education, and innovation in a mission. With about 9,300 employees and 25,000 students, KIT is one of the big institutions of research and higher education in natural sciences and engineering in Europe.**

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