SIEMENS

Background information

Munich, June 13, 2016

Radar sensors for A9 Digital Freeway Test Field

Siemens and Infineon have developed radar technology designed to improve traffic flow and avoid dangerous situations on one of the busiest freeways in Germany – with the help of autonomous vehicles in the future. New types of radar sensor developed by Siemens and Infineon communicate directly with the car, permitting more vehicles on the road because the infrastructure is used more efficiently, intelligently and safely.

This innovative technology is to be tested in the A9 Digital Freeway Test Field project initiated by the German Federal Ministry of Transport and Digital Infrastructure, with modern, forward-looking systems and technologies being tried out and evaluated on the A9 freeway in Germany. The aims: to eliminate bottlenecks and reduce hazards by offering drivers alternatives at an early stage and informing them of dangerous situations in good time.

The freeway as a digital test bed – on the road to autonomous driving

The A9 between Munich and Nuremberg, one of the most important traffic routes in Europe, is gradually being transformed into a test route for innovations. Using the slogan "Mobility 4.0", the German Federal Government, the Free State of Bavaria and companies such as Siemens and Infineon, are developing the A9 into a proving ground for the technologies of the future. There were good reasons for selecting a freeway. For the most part, traffic on freeways is already well controlled: all cars on a carriageway are going in the same direction, there are no junctions, and the hazards presented by cyclists and pedestrians are generally ruled out. The objective is to test automated, networked driving under real conditions.

Fast and smooth along the freeway

The objectives: optimize traffic flow, detect hazards, avoid accidents. In order to actively increase road safety, cars will be able in future to communicate with one

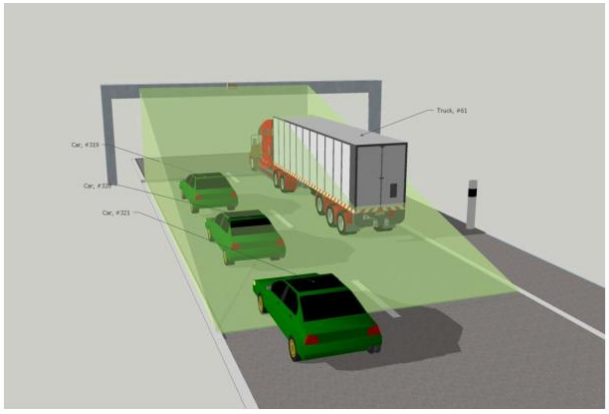
another - and the traffic infrastructure. Specifically, this means that each car can use its own sensors to collect information about the state of the roads and traffic conditions, and send this data to other cars or the control center. Since the sensor systems can be mounted on guide posts alongside the freeway, there is no need for major alterations to the infrastructure. The radar system operates in principle without recording images, thereby respecting the privacy rights of individual road users.
All data gathered through the radar systems will be available on the M-Cloud of the BMVI Open Source system. Creative minds from the automotive industry and digital economy as well as research institutes can use these data to develop innovative mobility solutions.

Radar technology is a very reliable detection method which, unlike optical sensors, is not impaired by light or weather conditions. The radar sensors are controlled by modern 77 GHz microchips made by Infineon. They have already formed an integral part of driver assistance systems for some years and they can, for example, maintain a constant distance to the vehicle ahead, and initiate or automatically perform emergency braking.
Assistance systems acquire and process ambient data reliably and can help to make driving safer and easier. This development has been made possible by sensors, controllers, power electronics and safety chips from Infineon. Microelectronics is the key technology for automated and networked driving.

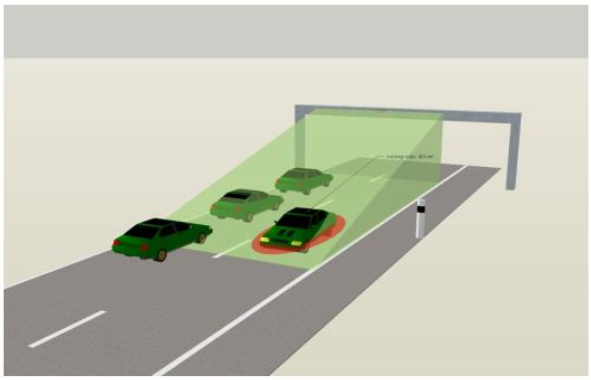
What the future holds

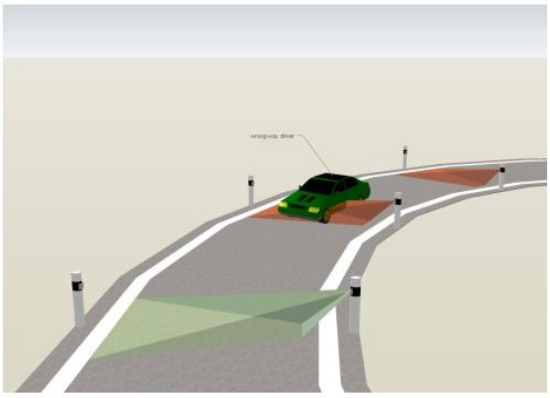
Step-by-step, a range of different fields of application is to be implemented on the A9 freeway – here's an initial overview:

- **Normal operation: Traffic flow**
  The type and nature of carriageway occupancy is determined. Detection of lane-by-lane actual speeds can be used to detect traffic jams and potentially dangerous situations. This includes counting individual vehicles to ascertain loading and determine the success of any countermeasures. In addition, a selective classification count of different types of road users can be implemented, in order to detect authorizations, for example.

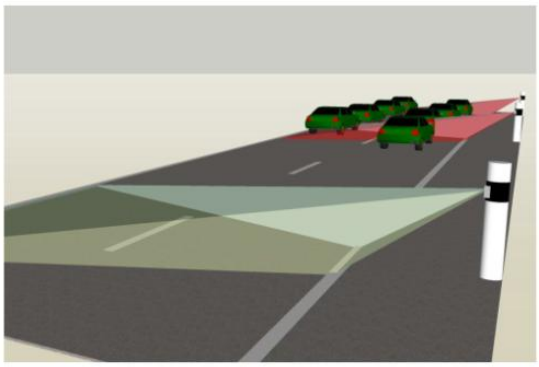


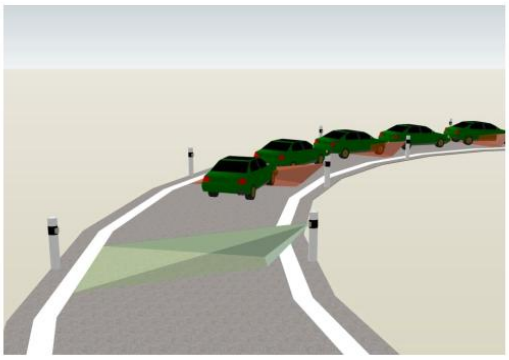
- **Deviation from normal operation: Wrong-way drivers**
  In Germany, about 1,800 wrong-way drivers are registered every year on the 13,000 kilometers of federal freeways plus around 3 350 kilometers of freeway-like federal highways. Using radar sensor technology, objects moving against the traffic flow in the wrong direction can be filtered out, either on the freeway or directly at the on and off ramps.





- **Deviation from normal operation: End of traffic jam detection**
  Monitoring by radar sensors is to be implemented at critical locations that are prone to congestion. This makes it possible to pinpoint the ends of traffic jams that may not be sufficiently detected by the vehicle's on-board sensors, thus preventing rear-end collisions or helping to identify and resolve bottlenecks by traffic flow management. Traffic jam detection can be implemented both on the freeway and at the on and off ramps.





- **Deviation from normal operation: Hard shoulder clearance and occupancy**

  A sensor network constantly monitors the hard shoulder, and reports its occupancy status to a control center. Local detection can be implemented with radar sensors that are integrated into delineator posts or safety barriers, or mounted in an exposed over-roadway position, for example. Traffic messages and restriction advisories, as well as warning notices for accident avoidance and action prompts are sent both to the control center and directly to vehicles. Hard shoulders which have been cleared for use increase road capacity enormously and advice about hard shoulder occupancy improve safety.