Prior to using an FPGA, Ibeo relied on an analog chip, "and we could use it to measure from up to 80 meters," Brumm said. "But that isn't good enough for adaptive cruise control, especially in Germany, where we tend to drive quite fast. Our customers told us that they needed it to measure 200 meters. It wasn't possible with an analog system. The idea was to do it with digital and the core measurement."

Specifically, the analog system had a limited V-range (area and width that the sensor could detect). "With an analog system you also have more noise in the signal, and that means we could see objects up to 80 meters and no more," said Brumm. "With the new FPGA system, if you have a big car or truck you will see up to 350 meters, which is absolutely unique for laser scanner systems. This is only possible because of the digital measurement, and it can detect very low energy."

Typically, said Brumm, these types of systems debut in luxury cars, such as the Mercedes S-class and BMW 7 series. "But our main goal is to bring down the cost so that these technologies can be widely deployed and available in all classes of cars," he said.

Brumm foresees great possibilities for merging laser technology with video. "Digital camera technology is nice because it allows you to see what's going on with your own eyes, but it can have the same drawbacks too," said Brumm. "For example, camera technology doesn't work in the dark, so designers need to augment it with night vision, which can be expensive. And digital camera processing typically requires a lot more data processing than laser technology." Lasers, for their part, are not "hindered by darkness or even fog," he said.

But cameras could eliminate some issues with laser scanners. For example, laser scanners have trouble distinguishing pedestrians from trees. Pairing a laser with a camera would allow the sensor to react appropriately, Brumm said. If, for example, it seemed unavoidable that the car was going to hit a tree, the system would send information to other sensors to protect the driver. And if it sensed the car were about to hit a pedestrian, it could send information to other sensors to help protect the potential victim, perhaps activating an airbag under or on the hood of the automobile.

FPGAs are also playing a key role in aftermarket DA systems. PLX Devices, for example, developed its first product—an award-winning, user-customizable multifunctional gauge popular with car enthusiasts—with a Xilinx FPGA platform. The company then built Kiwi, a mainstream consumer product, which in a fun way helps drivers monitor their fuel efficiency. Xilinx devices are central in that design as well (learn more about PLX Devices and its CEO, Paul Lowchareonkul, in the Profile of Xcellence section in this issue).

The End Market and Liability Restrictions

While engineers have made leaps and bounds in developing ever more advanced DA systems over the last 10 years, just about everyone in this market is aware that each step of sensor fusion progress has to be tempered and well thought out to consider the real value to the driver as well as regional liability constraints.

Indeed, the experts interviewed for this story, including Barnden, Zoratti, Brumm and Thompson, all noted that one of the reasons manufacturers in Europe and Japan are leading the way in DA development—and why consumers in those regions typically become the early adopters—is largely because legal liability is a much bigger issue in the United States. As a result, auto manufacturers are far more cautious in introducing new features into the U.S. market.

Most of the DA systems discussed here are merely assistance features that provide the driver with information; ultimately, it's the driver who is responsible for making the right decisions—and the driver who bears the liability. However, it's not unforeseeable that as advanced sensor fusion technology progresses, many of these systems could be tied directly to safety systems.

Some say the rapid evolution of DA systems is even a crucial step toward achieving the automotive industry's holy grail of driving: the autonomous vehicle—a day, perhaps in the not too distant future, when cars can drive themselves and in doing so, alleviate traffic congestion and lower fuel consumption, while drastically reducing traffic-related injuries.