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A Different View

By Christopher A. Sawyer, Executive Editor

Accepted vision sensors have a new competitor: an inexpensive silicon-based 3D vision chip.

There is a basic reason most advanced safety systems appear in an OEM? s most expensive vehicles first before migrating slowly through the rest of the lineup: Cost. Not only do new technologies cost a lot to develop, the technologies necessary to make them work as advertised don? t begin to drop in price until volumes rise and less expensive alternatives are introduced. This is true of automotive vision technologies, and is one major reason safety systems like Adaptive Cruise Control (ACC), Lane Departure Warning (LDW), Park Assist (PA), Lane Change Support (LCS), and others have been slow to make it from the lab to the road? or from the top of the line to the bottom. Especially since the systems, as currently configured, have sensing requirements just different enough to demand their own sensor array. That may be about to change.

The CanestaVision chip, lens and IR light source are very compact, and have the potential to eliminate the need for much more expensive sensors in advanced safety systems.

The engineers at Canesta, Inc. (Sunny Vale, CA; www.canesta.com) think they have a solution to that problem, a 3D vision chip that can both identify objects and determine their range; one that will perform the functions of more expensive sensors, but add the additional functionality of being able to determine the closing rate of an object in its view. ? The long-term vision,? says Jim Spare, v.p, Marketing at Canesta, ? is to have a sensor in the front, one in the back, and one on either side of the vehicle performing multiple functions for the vehicle? s safety systems.? The potential to cut cost by removing redundant hardware is seductive, especially since this module will cost somewhere between $5 and $50 each, versus as much as $300 for a single radar unit. This means an OEM or supplier could use up to six CanestaVision units for the price of one high-end radar sensor, thus greatly increasing the chance that advanced safety systems will proliferate.

The heart of the unit is a CMOS chip with a lens that focuses infrared (IR) light? from a light source located in the module or mounted remotely? onto it. The light source is turned on and off at a very high rate, and the distance traveled is measured at each pixel on the chip. This information is processed at a nominal 60 frames per second (full-motion video requires 24 frames per second), and the phase delay information is measured in picoseconds between pixels. The ability to do the light demodulation/phase detection calculations in the hardware is the key innovation. ? Each pixel has two gates,? says Spare, ? and we read the differential voltage between them, which allows us to create a 3D image with range information.? Information that also can be used to create 3D images for security or navigation systems.

Spare claims each of the major automotive suppliers and a few OEMs already have bought development kits? a 2-in. by 4-in. module containing the CanestaVision chip and integral 3D camera? and the software that allows the developer to begin creating a 3D-enabled system. This device is the basis of the third-generation chip Canesta expects to supply for model year 2009 vehicles. Bumper-mounted ultrasonic parking sensors? which are easily damaged? are an early candidate for replacement, as are the radar units used in Adaptive Cruise Control and Lane Departure Warning systems. ? From there,? says Spare, ? it? s up to the imagination of the OEMs and suppliers.?

The Data Fusion Roadmap

Passive Systems	**Active Systems**
Phase 0:	
Restraint Enhancement	Longitudinal Enhancement
Front and Side Impact Airbags	Traction Control (TCS)
	Automatic Cruise Control (ACC)
Phase 1:	
Protection Enhancement	Cornering Enhancement
Rollover Protection	Body Control Systems
Occupant Sensing & Adjustment	Roll Control
	Electronic Stability Control (ESC)
	Steering Assist
Phase 2:	
Advanced Adaptive Approach	Ride & Handling Enhancement
Active Control Belt Retractor	Parking Assist
Advanced Occupant Sensing	Follow/Stop ACC
Restraint Response Tailoring	Rear Wheel Steer
	Suspension Control
	Integrated Vehicle Systems
Phase 3:	
Enhanced Safety Systems	Highly Reactive Vehicle Control
Anticipatory Crash Sensing	Lane Change Support
Pedestrian Protection	Lane Keeping
	Collision Warning/Stop & Go ACC

THE DATA FUSION REVOLUTION

Data fusion is the next frontier for safety technology and a potential growth segment for suppliers who can supply the hardware and integration expertise that allows passive and active systems to work together. ? Active and passive safety are converging as we interlink these systems to provide greater benefits than are possible if we deal with them as stand-alone products,? says Phil Cunningham, director, Product Planning and Business Development, TRW Automotive (Livonia, MI; www.trw.com). The reasons are quite simple. First, as sensors proliferate around the vehicle, the data created can be used by other safety systems to prepare for, mitigate, or avoid a crash situation. Second, the limitations of passive safety systems are being reached and their cost-effectiveness is falling rapidly. Third, linking the systems reduces the societal cost of accidents, and may reduce insurance rates over time. Fourth, though the number of deaths per 100 million vehicle miles traveled continues to decline, the total number of traffic deaths remains stuck between 40,000 and 50,000 deaths per year. ? The next level of value will come from systems that work together,? says Cunningham. ? The things that we can accomplish through data fusion? allowing sensors and systems to communicate with each other to provide the best response to a situation? are limited

only by our imagination.?