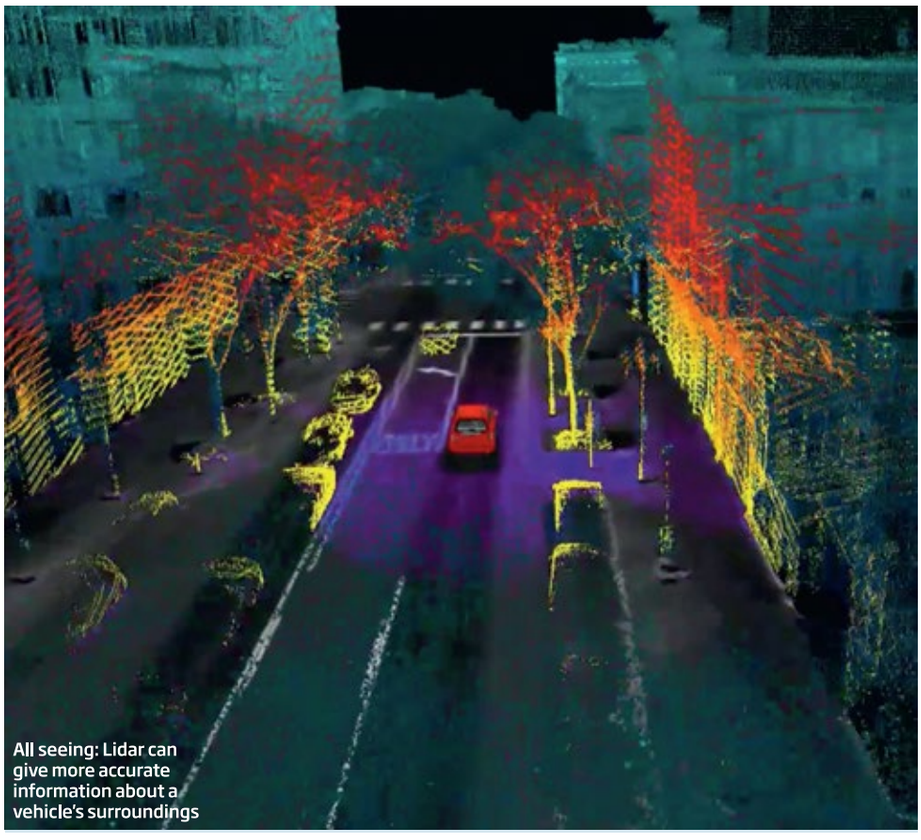
So solid view

More powerful silicon technology is helping to bring autonomous vehicles to the roads, and lidar could be the sensor of choice to give them a 360° picture of the world

By James Scoltock



All seeing: Lidar can give more accurate information about a vehicle's surroundings

Increasingly powerful microchip technology from the consumer electronics industry is helping OEMs and suppliers to develop more effective safety systems. Silicon is becoming ever more important as firms move towards autonomous vehicles and the number of sensors increases. This is pushing the need to fuse data from radar and cameras, but also from advanced sensors.

To help vehicles drive autonomously, firms are developing lidar systems that can build up a 360°, 3D view of the surroundings and any obstacles.

"There is no other technology that allows you to do object detection with such high confidence," said Louay Eldada, chief executive of technology firm Quanergy. "A 99% success level is unacceptable if it means you miss one pedestrian out of 100. We're talking about close to 100% detection."

Lidar is already used by OEMs and suppliers in research vehicles. Ford has integrated the technology, using a lidar system to aid obstacle detection. But whereas OEMs and suppliers are using it in conjunction with other sensors, the technology could be applied on its own, reducing system complexity, said Eldada. And he thinks what could make it a success is the amount of data that could be captured.

"Ford's test vehicles have four 32-beam lidars collecting 625,000 3D points per second and up to 28 bytes of data per point and 100MB per second," he said.

"We can collect 864,000 3D points per second, with 144 bytes of data per point. We use a gigabyte-per-second Ethernet connection which allows you to collect a lot more data than just range. You can read road signs and a lot more."

Processing such huge amounts of data would have been problematic in the past, but mobile chip technology is allowing firms such as Quanergy to overcome that challenge. "We're using an Nvidia Tegra K1 processor to do realtime object detection, tracking, identification, classification and scenario analysis," he said.

The chip incorporates a quadcore ARM Cortex-A15 CPU and 192 graphics cores, which help the system to detect everything you could encounter on the road: pedestrians, animals, and features from debris to speed bumps.

Quanergy's system is also linked to the cloud, so it can compare realtime information to stored map data.

Simultaneous localisation and mapping, where the user is aware of the environment and constantly comparing it to stored data, will give much richer information to the driver and, in the longer term, to autonomous vehicles.

"It gives you information on traffic flow, weather, road conditions and infrastructure. And ultimately, with autonomous vehicles, maps that are updated frequently, while also supported with GPS data, can give centimetre-accurate localisation," said Eldada.

There are still challenges to overcome. Perhaps the biggest is cost – lidar systems are expensive. While he hopes costs might be reduced by economies of scale driven by greater use in military vehicles, more has to be done.

"Our first-generation lidar is mechanical, but next year we will have a solid-state system which is lower-cost," he said.

The second challenge is robustness. Changing environmental conditions could impede the signals the lidar receives. This is partly why autonomous vehicles use a suite of sensors, fusing data from each, rather than relying on just one.

Lidar clearly holds great potential for helping autonomous vehicles to see obstacles ahead. But the technology's price needs to be reduced, and its durability proven, before it can be used in volume applications. Improvements in chip technology will allow all the data to be processed, so that the system can eventually fulfil its potential in cutting the number of accidents. ■

Louay Eldada was speaking at the GPU Technology Conference in California.

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