

# Lane Keeping

Systems for keeping inside the lines are growing up, but they're still not perfect

By Lucas Laursen

Posted 30 Apr 2014 | 17:34 GMT

Drifting across the desert for a music video: [cool](https://www.youtube.com/watch?v=2uYsogJD-LE) (<https://www.youtube.com/watch?v=2uYsogJD-LE>). Drifting around a test track in an autonomous car: also cool. (<https://www.youtube.com/watch?v=krJmTZ-TcMc>) Drifting out of your lane on the highway: *not* cool. Carmakers have been warning drivers not to leave their lanes since 2001, with subtle hints such as audible beeps or vibrating steering wheels. These early systems used cameras to track lane lines painted on the road. A decade ago, Toyota's first lane-keeping system took over the steering wheel and nudged wayward cars back into line when the driver would not. But because these systems relied on cameras and early image-processing algorithms, they worked only where the lines were clear and in good visibility.

Today's lane-keeping systems are evolving. The Volkswagen Touareg can track a single lane stripe, and the company [claims](http://en.volkswagen.com/en/innovation-and-technology/technical-glossary/spurhalteassistentlaneassist.html) (<http://en.volkswagen.com/en/innovation-and-technology/technical-glossary/spurhalteassistentlaneassist.html>) that the car can track lanes in the dark and in the fog. It manages the feat with a single camera, unlike some systems that use stereoscopic cameras or include information from a radar or other additional sensor.

That choice reveals some sophistication on the part of the image-processing software. Stereo vision would give the car's processors depth perception to a certain distance, and radar might help it work when the sun is low, blinding the camera. Yet Volkswagen claims its single lane-keeping camera has enough range for highway driving. It does not, however, work below 65 kilometers per hour (40 miles per hour), which may be a strategic decision to prevent drivers from trying to use the system in more dangerous and complex urban settings. Local roads have less-continuous lane markings than highways and are more likely to have obstructions blocking the car's field of view and nearby obstacles.

Bringing control to lower-speed lane-keeping systems would also require exerting more torque on the steering wheel than highway-speed lane-keeping systems do. The company would not provide further details on how its image-processing system works, but it is a safe bet that it was developed in conjunction with a third-party supplier and customized for Volkswagen.

Image processing is just the start, however: Senior research scientist [Eddy Llaneras](https://secure.hosting.vt.edu/www.apps.vtti.vt.edu/staffdir/bio.php?pn=112973) (<https://secure.hosting.vt.edu/www.apps.vtti.vt.edu/staffdir/bio.php?pn=112973>), at the Virginia Tech Transportation Institute, in Blacksburg, Va., says that a more interesting technical problem is the transition from warning to active control. It also defines the major divide between existing commercial systems. Some are just lane-departure warning systems; the best also nudge the wheel or brakes to help keep a car in its lane. The latter rely on already-existing stability control systems that prevent drivers from overcorrecting, for example, and which are part of today's lane-keeping assistants.

Lane keeping requires the crucial latitudinal axis of car motion. Werner Huber, BMW's head of driver assistance and perception, told *IEEE Spectrum* last year that "the big jump is now to take over control of the car in the longitudinal *and* latitudinal direction." For cars that already have advanced cruise control, the temptation to let the car handle both axes is so great that carmakers, including BMW and Volkswagen, deactivate their driver assistance systems if the driver's hands leave the wheel for more than a few seconds. Someday, the opposite may be true: The car may squawk if the driver tries to take the wheel.

## Car Manufacturers

### Maker

[Audi](http://www.audi-electronics-venture.de/aev/brand/en/projects/audi_active_lane_assist.html) ([http://www.audi-electronics-venture.de/aev/brand/en/projects/audi\\_active\\_lane\\_assist.html](http://www.audi-electronics-venture.de/aev/brand/en/projects/audi_active_lane_assist.html))/[Volkswagen](http://en.volkswagen.com/en/innovation-and-technology/technical-glossary/spurhalteassistentlaneassist.html) (<http://en.volkswagen.com/en/innovation-and-technology/technical-glossary/spurhalteassistentlaneassist.html>)

BMW

[Ford](http://www.gottabemobile.com/2013/07/27/own-a-self-driving-car-by-purchasing-lane-keep-assist/) (<http://www.gottabemobile.com/2013/07/27/own-a-self-driving-car-by-purchasing-lane-keep-assist/>)

[GM](http://media.gm.com/media/us/en/gm/news.detail.html/content/pages/news/us/en/2014/jan/14naia/cadillac/0114-) (<http://media.gm.com/media/us/en/gm/news.detail.html/content/pages/news/us/en/2014/jan/14naia/cadillac/0114->

### The Self-Driving Car (/static/the-self-driving-car)

How Self-Driving Cars Will Sneak Onto Our Roads (/transportation/self-driving/how-selfdriving-cars-will-sneak-onto-our-roads)

Adaptive Cruise Control and Traffic-Jam Assistants (/transportation/self-driving/adaptive-cruise-control-and-trafficjam-assistants)

Self-Parking (/transportation/self-driving/selfparking)

Lane Keeping (/transportation/self-driving/lane-keeping)

Autonomous Emergency Braking (/transportation/self-driving/autonomous-emergency-braking)

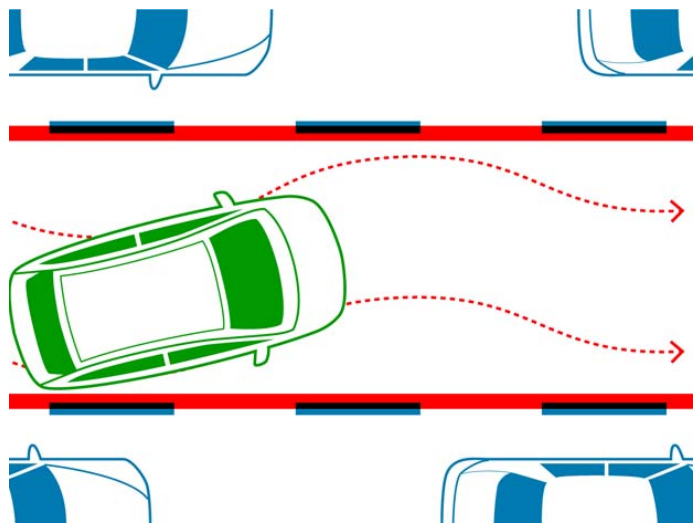


Illustration: mckibillo

### Lane-Departure War

<http://www.bmw.com/com/en/insights/technology/technology>

[naias-ats-coupe.html](#))

[Honda \(https://www.youtube.com/watch?v=tcuhaddb2n4\)](https://www.youtube.com/watch?v=tcuhaddb2n4)/[Acura \(http://m.acura.com/owners/2014/rx/howto/lane-keeping-assist-system\)](http://m.acura.com/owners/2014/rx/howto/lane-keeping-assist-system)

Mercedes-Benz

[Toyota \(http://www.toyota-global.com/innovation/safety\\_technology/safety\\_technology/technology\\_file/active/lka.html\)](http://www.toyota-global.com/innovation/safety_technology/safety_technology/technology_file/active/lka.html)/Lexus

[Volvo \(https://www.media.volvocars.com/global/en-gb/media/videos/126498/lane-keeping-aid\)](https://www.media.volvocars.com/global/en-gb/media/videos/126498/lane-keeping-aid)

## Automotive parts suppliers

[Bosch \(http://www.bosch-automotivetechology.com/en/de/driving\\_safety/driving\\_safety\\_systems\\_for\\_passenger\\_cars\\_1/driver\\_assistance\\_systems/driver\\_assistance\\_systems\\_2.html\)](http://www.bosch-automotivetechology.com/en/de/driving_safety/driving_safety_systems_for_passenger_cars_1/driver_assistance_systems/driver_assistance_systems_2.html)

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[Continental \(http://www.conti-online.com/www/automotive\\_de\\_en/themes/commercial\\_vehicles/safety/adas/ldw\\_lks\\_en.html\)](http://www.conti-online.com/www/automotive_de_en/themes/commercial_vehicles/safety/adas/ldw_lks_en.html)

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[Delphi \(http://delphi.com/manufacturers/auto/safety/active/warning/\)](http://delphi.com/manufacturers/auto/safety/active/warning/)

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[TRW \(http://ir.trw.com/releasedetail.cfm?releaseid=811062\)](http://ir.trw.com/releasedetail.cfm?releaseid=811062)

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Valeo

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