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Smart Headlight Illuminates the Road without Blinding Other Drivers

Computerized headlights could eliminate glare from oncoming cars while improving visibility.

By Iddo Genuth on September 19, 2014

If you hate it when the driver in the opposite lane blinds you with his high beams, or when the glare from the truck behind keeps you from looking in the rearview mirror, a solution might be just around the corner. An experimental programmable headlight automatically adjusts thousands of tiny, individually controlled light sources to prevent other drivers from being blinded while still highlighting signs or obstacles ahead.

Researchers from Carnegie Mellon and Intel developed the prototype headlight, which scans the road ahead using an infrared camera and can locate other drivers and selectively disable the light directed at them, and it can do this at up to 140 miles per hour. Although it reduces glare for oncoming drivers, it doesn't make the road noticeably darker for the person behind the wheel.

The headlight could perform other useful tasks. It could highlight hard-to-see objects in the dark; show the driving lane when it is not marked or well-lit; project navigational information on the road in front of the driver; or even reduce the glare during a snowfall by distributing light between snowflakes. Improving the ability to drive in the dark and in other low-visibility scenarios could help save at least some of the 32,000 people who die in car accidents each year in the U.S.

Although adaptive headlights already have been introduced in recent years by car manufacturers such as BMW, Audi, Mercedes, and Volvo, they are typically much slower and less finely controlled. They point the way around a corner or dim the lights if a pedestrian is crossing, but they lack the ability to improve lane illumination.

The Carnegie Mellon-Intel prototype includes a camera, a computer, and a digital projector. Information from the infrared camera is processed by a computer that tries to identify relevant objects on the road, such as cars, pedestrians, or road signs. The projector uses a light source that's 4,700 lumens (much brighter than a halogen headlight) with an array of almost 800,000 micromirrors that can be controlled individually by the computer.

The ability to control the light with so many micromirrors provides a high-resolution, highly tunable system that can also turn on and off every “pixel” in just under one millisecond (the flap of a fly wing takes almost three times as long).

John Leonard, a professor of mechanical engineering at MIT who was not involved in the research, says the Carnegie Mellon programmable headlight could improve automotive machine vision. “This is a great example of taking ideas from computer vision and applying them to a challenging real-world problem,” he says. “This is a known stumbling block for self-driving vehicles, and one can envision how the extension of these concepts might lead to better sensors for advanced active safety and driverless car systems.”

The Carnegie Mellon team, which recently presented its findings at the European Conference on Computer Vision in Zurich, Switzerland, is still modifying the prototype, which should be finished within the next six months. Over the next two years the team plans to miniaturize the components and make the system faster. Robert Tamburo, lead engineer for the project, says: “We are currently exploring all options to bring our headlight design to market.”

Credit: Images courtesy of Carnegie Mellon, ILIM laboratory

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