Retroreflective projection technology gives driver safer view

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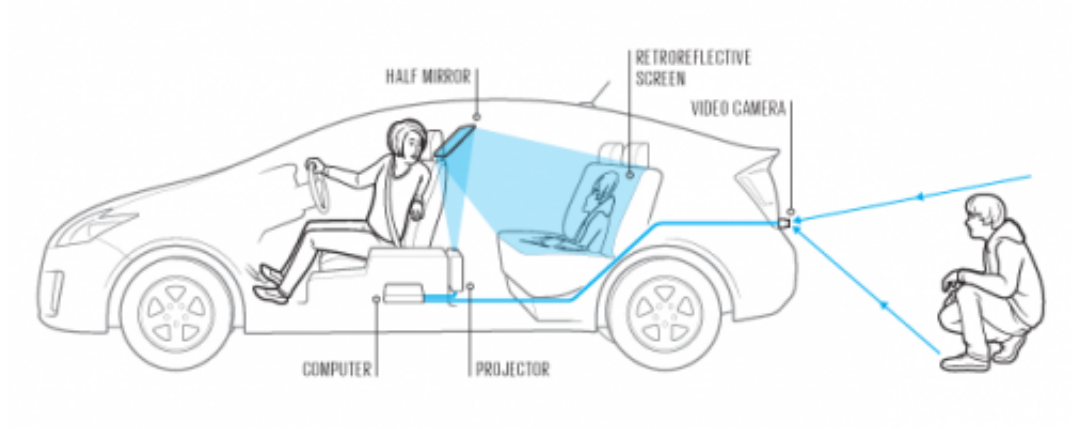

Credit: James Provost/IEEE Spectrum

How might drivers see around blind spots? The answer may be in a technique where the child crouching behind the car, the toddler who breaks free from a controlling hand and starts running alongside the car, the teen on the bike riding dangerously close to the car, can all be seen and not obscured. Profs. Susumu Tachi and Masahiko Inami from the Graduate School of Media Design at Keio University in Japan and Yuji Uema, who is a Ph.D. candidate there, wrote a detailed article about their work in *IEEE Spectrum* along with a video showing their "truly transparent car" system which they devised at Keio University.

The system involves a half mirror, PC, lens array, webcam, and projector—simple components, "but the real magic," said the video, "is

in the retroreflective screen." Retroreflection allows the system to align the projected image with the eye of the observer. "With the right screens in the right place, the car appears to be made of glass," they said. According to the article, "Retroreflectors return an incident ray of light directly to its source, allowing a projector to display the appropriate image to the driver no matter where she may be directing her gaze. The reflectors are coated with tiny beads, whose internal optics do the trick." In an earlier version of their system, the driver had to wear a special headset for tracking movements. The researchers found this to be cumbersome, and they figured out an alternative, to rig the system on the car, not the driver.

Cameras on the outside of the car capture the obscured visuals. That data is processed and the images are sent to a projector on the floor behind the driver. The projector sends light up to the half-mirror. Part of the beam reflects on to a back seat lined in retroflective material. The other part passes through the half mirror to the ceiling, also lined with the material. This allows the driver to see both forms of the image in the half mirror—the version transmitted from the back and the one reflected from the ceiling. A driver can see what's behind the car even if something is blocking the back seat.

They said the technology could be used anywhere, not just in a car, where you need a window. "Our technology may find wider application—wherever we need to see through things," they wrote in *IEEE Spectrum*. They said "this technology could be used in the cockpit of an airplane to make the floor transparent during landing, enabling the pilot to see the runway in full view." Another example they gave was in a factory, where "a skilled craftsman might wear a glove made of retroreflective material. An image could be projected onto the glove showing tiny objects—such as those involved in the testing of circuits—that would otherwise be obscured by the craftsman's hand."

The team said they are collaborating with several automakers and automotive electronics companies in turning the concept into a commercial system.