New traffic signal would improve travel time for both pedestrians and vehicles, says modeling study

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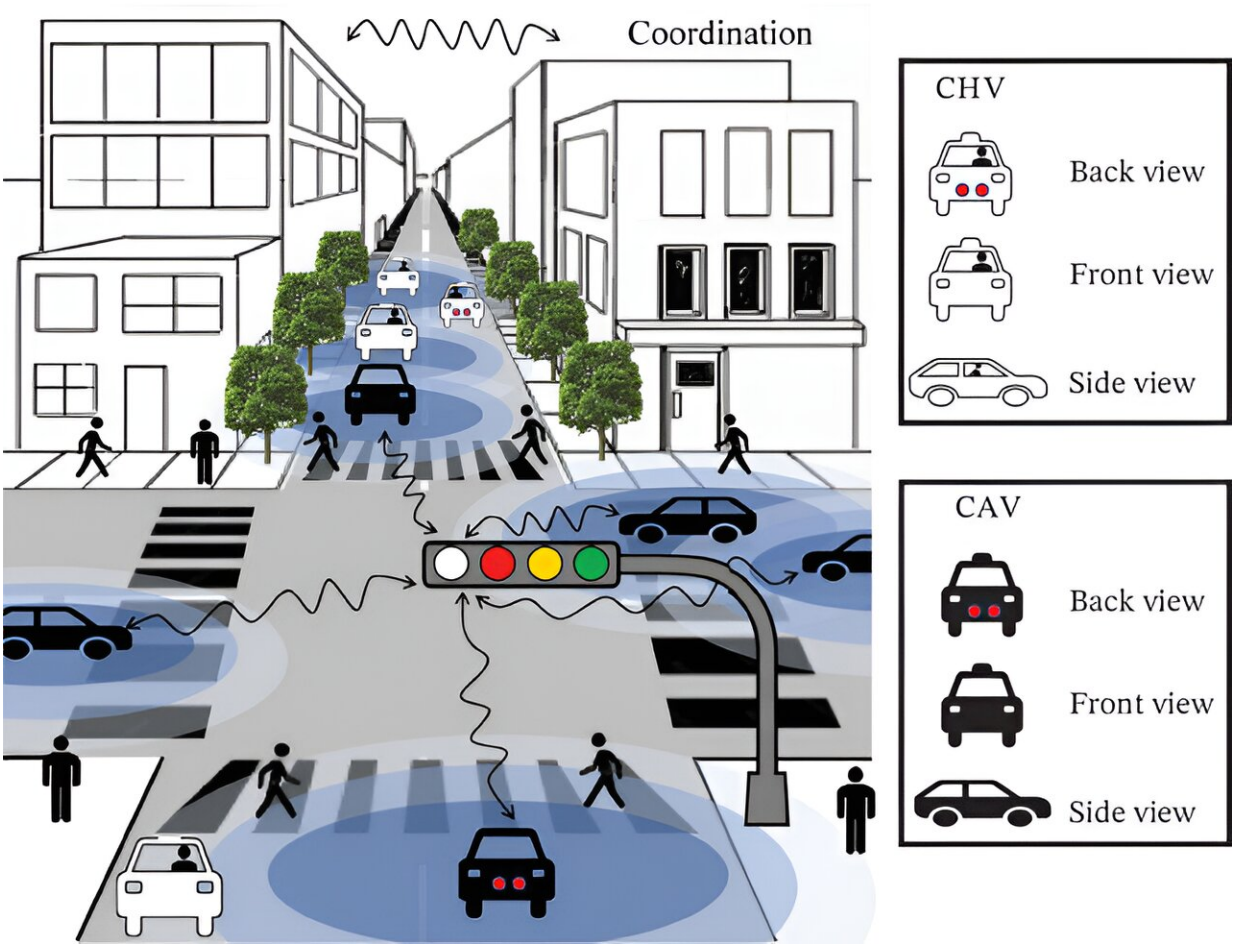

Schematics of an intersection with white phase, connected automated vehicles (CAVs), connected human-driven vehicles (CHVs), and pedestrians. Credit: *Computer-Aided Civil and Infrastructure Engineering* (2024). DOI: 10.1111/mice.13178

Adding a fourth light to traffic signals—in addition to red, green, and yellow—would shorten wait times at street corners for pedestrians, as well as improve traffic flow for both autonomous vehicles and human drivers. And the more autonomous vehicles there are in the traffic network, the shorter the wait times for everyone.

"Our earlier work introduced the idea of a fourth traffic signal called a 'white phase,' which taps into the computing power of autonomous vehicles (AVs) in order to expedite traffic at intersections—but we had not yet incorporated what this concept would mean for pedestrians," says Ali Hajbabaie, corresponding author of the paper and an associate professor of civil, construction and environmental engineering at North Carolina State University.

"We've now expanded our computational modeling to account for foot traffic, and the results are extremely promising for both pedestrians and vehicles."

The white phase concept makes use of AVs' ability to communicate wirelessly with both each other and the computers that control the traffic signals. When enough AVs are approaching the intersection, this would activate a new traffic light—the white light.

While red lights mean stop, and green lights mean go, white lights tell human drivers to follow the car in front of them simply. In short, the white light is a signal that AVs are coordinating their movement to facilitate traffic through the intersection more efficiently.

"Our previous research found that the more AVs there are on the road, the more efficiently the traffic moves," Hajbabaie says. "To be clear, this improves travel time, fuel efficiency, and safety for all of the cars

on the road—not just AVs."

To account for pedestrian traffic, the researchers incorporated a suite of new parameters into the optimization model that assessed the impact foot traffic would have on all traffic through an intersection.

"We found that, when pedestrians are added into the mix, the white phase concept still improves traffic efficiency for everyone," Hajbabaie says. "And, again, the higher the percentage of traffic that is made up of AVs, the more efficiently traffic moves through intersections.

"If at some point in the future, we see almost universal adoption of AVs, our models suggest that delays at intersections would decrease by more than 25%. More realistically, we will eventually see a lower percentage of wirelessly connected AVs on the road, but there would still be meaningful improvements in traffic time."

The researchers know that governments will not be adopting these new traffic technologies in the immediate future but are already taking steps to ensure that future pilot projects will be safe and effective.

"We are currently setting up a physical testbed that will allow us to experiment with this concept in the physical world—not just in a computer model," Hajbabaie says. "However, the vehicles we are using in the testbed are small enough to hold in your hands. This will help us identify challenges in implementation without the expense—and safety risk—involved with using full-scale vehicles. In the meantime, we are open to working with industry and research partners to explore ways to move forward with these technologies."

The paper, "Advancing the White Phase Mobile Traffic Control Paradigm to Consider Pedestrians," is published open access in the journal *Computer-Aided Civil and Infrastructure Engineering*.

More information: Ramin Niroumand et al, Advancing the white phase mobile traffic control paradigm to consider pedestrians, *Computer-Aided Civil and Infrastructure Engineering* (2024). DOI: 10.1111/mice.13178

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