Cars could soon negotiate smart intersections without ever having to stop

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Credit: Steffen Thoma/Public Domain

Sick of waiting at traffic lights? The semi-autonomous driving aids being fitted to many new cars could consign the red light to history, A*STAR researchers report. According to their modeling, a system in which each car crosses the intersection in its own virtual bubble of safe space, modulating its speed using adaptive cruise control, will result in smooth traffic flow in each direction.

In the city of the near future, traffic lights would be complemented by and then replaced with a communication beacon, explains Bo Yang from the A*STAR Institute of High Performance Computing, who led the work. The beacon gathers and transmits data about the distance and approach speed of vehicles nearing the intersection, which each car feeds into an algorithm that plots a safe course through without having to stop.

At the algorithm's heart is the concept of "adaptive repulsive force". The closer two cars' trajectory would bring them at an intersection, the stronger their repulsion and the greater the speed adjustment they make to pass each other safely.

Yang set out to reduce barriers to adoption of this system. "One of our most interesting findings is that the rules governing the necessary repulsion between vehicles is rather simple," he says. The result is a system that does not require much computing power at the beacon or in the vehicle itself.

Cars need not be fully self-driving, but rather simply able to brake and accelerate autonomously – which cars fitted with smart cruise control can already do. The driver gives up control of the car's speed through the intersection but remains in charge of steering.

In Yang's simulations, the algorithm worked effectively even for relatively complex intersections. "In most cases, pre-emptive deceleration only slightly lowered the vehicle velocity, resulting in safe passage of each vehicle across the intersection without coming to a full stop at any point," Yang says.

The system's other advantage is that it could be phased in gradually. Initially, traffic lights would still be needed to help older cars pass through the intersection. As smarter cars become prevalent, the lights

can switch off for more and more of the time until they are no longer needed at all. "Our simple algorithm only requires basic vehicle intelligence, but is also fully compatible with more intelligent vehicles that may come in the future," Yang adds.

More information: Bo Yang et al. Efficient intersection control for minimally guided vehicles: A self-organised and decentralised approach, *Transportation Research Part C: Emerging Technologies* (2016). DOI: 10.1016/j.trc.2016.10.004

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