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The dissemination of warning messages in a reliable and timely fashion is critical for safety in vehicular ad hoc networks. Conventional telematics solutions use a radar-type mechanism that detects an obstacle ahead of a vehicle and then activates the brakes to avoid a crash. But this technology lets vehicles perceive an obstacle only when it’s physically in front of them. If vehicles could talk to one another, they could see what’s happening kilometers ahead. This alert could be sent via satellite communication and GPS devices with enriched functionalities, but latency is prohibitive.

Possible solutions to this challenge include spreading the alarm down a chain of vehicles in a relay; cars could also communicate via Wi-Fi or a smartphone application.

But if we flood the system with alarm messages, starting from the crash scene out to each vehicle, it could become clogged with messages. To prevent this secondary “traffic jam,” an emerging sender-oriented solution simply passes the crash message to a dedicated well-positioned vehicle at the limit of onboard Wi-Fi’s broadcast range or that has a powerful transmission range. But, as Junliang Liu, Zheng Yang, and Ivan Stojmenovic at Tsinghua University observed, the dedicated vehicle could miss the message, or the alarm could “jump” over some vehicles, especially at intersections, never delivering the alarm to them (“Receiver Consensus: On-Time Warning Delivery for Vehicular Ad-Hoc Networks,” IEEE Trans. Emergent Topics in Computing, vol. 1, no. 1, 2013, pp. 57–68). Such problems are avoided in receiver-oriented solutions, in which vehicles locally determine which one can best forward the alarm signal.

In the authors’ proposed approach, vehicles autonomously agree on forwarding strategies, without additional messages passing between them. A receiver consensus algorithm has each forwarding candidate rank itself and its neighbors (who affirmatively or potentially received the message) by distance to the centroid of neighbors in need of the message. The candidate then assigns forwarding priority among neighboring nodes and suppresses unnecessary retransmission, while enabling the best nodes to transmit the packet without waiting. The lack of an alarm acknowledgment in a vehicle’s beacon message can trigger additional transmissions from its neighbor, thus theoretically guaranteeing delivery.

The authors have validated their proposed method’s effectiveness and efficiency through extensive simulations under 802.11p settings. Their results demonstrate that the protocol achieves the high reliability of leading state-of-the-art solutions for data dissemination, while significantly enhancing timeliness by dedicating itself to broadcasting emergency messages in 2D vehicular networks. The solution eliminates redundant parameters and is a promising approach to implementing a warning system in vehicles.

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