Power adaptive selective broadcast in vehicular ad hoc networks for improved traffic safety

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Vehicular communications are one of the new challenging application areas for mobile ad hoc networks, and vehicle collision warning is one of the very promising potential applications in this field, since traffic accidents cause hundreds of thousands of fatalities and injuries every year. Selective broadcast is a very popular method to deliver a warning message to all vehicles within a certain zone of interest without flooding the network with packets, thanks to its "selective" nature regarding packet relaying decisions. Due to the life-critical nature of emergency applications, however, it is essential to ensure the solutions to be deployed work with almost 100% success rate, thus meeting the high standards required, even under extremely unfavourable conditions. In sparse networks, for instance, where node connectivity is low, message dissemination becomes very difficult, and it is necessary to take additional measures in order to keep all nodes informed. In our study, we developed a power adaptive selective broadcast algorithm for information dissemination in vehicular ad hoc networks. To improve the collision warning delivery ratio in sparse networks, the vehicles in our algorithm gradually increase their transmission power with each repeated message. To address the effectiveness, efficiency, convergence time, and propagation speed of our algorithm, we defined four performance criteria for evaluation. We thus compared our algorithm to two other, non-adaptive, selective broadcast protocols, and to flooding, which is a well-known trivial method of message dissemination. We evaluated the warning delivery performance of the algorithms under identical, realistic simulation conditions using ns-3. The results we obtained show that it is possible to achieve a significantly higher warning delivery success rate with an adaptive protocol, particularly in sparse networks, where other algorithms suffer from lack of connectivity. The results also help us to understand better the design requirements of a high-performance intelligent broadcast algorithm.

Index Terms *– intelligent transportation systems, traffic safety applications, vehicular communications, adaptive transmission power, selective broadcast algorithms.*

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