Preface

Road accidents represent a serious social problem and are one of the leading causes of human death and disability on a global scale. To reduce the risk and severity of a road accident, a variety of new safety applications can be realized through wireless communications among vehicles moving near each other, or among vehicles and especially deployed road side units (RSUs), a technology known as a vehicular ad hoc network (VANET). Most of the VANET-enabled safety applications are based on broadcasting of safety messages by vehicles or RSUs, either periodically or event-driven, such as in case of a hard brake or dangerous road condition detection. Each broadcast safety message should be successfully delivered to the surrounding vehicles and RSUs without any excess delay, which is one of the main functions of a medium access control (MAC) protocol in VANETs.

This brief presents VeMAC, a new multichannel time division multiple access (TDMA) protocol specifically designed to support the high priority safety applications in a VANET scenario. The ability of the VeMAC protocol to deliver periodic and event-driven safety messages in VANETs is demonstrated by a detailed delivery delay analysis, including queueing and service delays, for both types of safety messages. As well, computer simulations are conducted by using MATLAB, the network simulator ns-2, and the microscopic vehicle traffic simulator VISSIM, in order to evaluate the performance of the VeMAC protocol, in comparison with the IEEE 802.11p standard and the ADHOC MAC protocol (another TDMA protocol proposed for ad hoc networks). A real city scenario is simulated and different performance metrics are evaluated, including the network goodput, protocol overhead, channel utilization, service fairness, probability of a transmission collision, and safety message delivery delay. It is shown that the VeMAC protocol considerably outperforms the existing MAC schemes in delivering periodic and event-driven safety messages in VANETs.

The proposed VeMAC protocol can be applied for many advanced safety applications to enhance the public safety standards and improve the safety level of drivers/passengers and pedestrians on roads. This research sheds light on TDMA as a promising technology for MAC in VANETs, and a suitable replacement of the IEEE 802.11p standard, which has significant limitations in supporting VANET safety applications.

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