Chapter 6

Conclusion

In vehicle networks, all sorts of communication are based on broadcasting. Therefore, broadcasting methods should tackle the broadcast storm problem in order to achieve two key goals: the first is to prevent the loss of valuable data during a broadcast cycle, and the second is to minimize the redundancy overhead of data. Nevertheless, it remains difficult to achieve data reliability while retaining a high delivery ratio and a minimal broadcast latency.

This dissertation investigates vehicle ad hoc network data dissemination strategies that fulfill the requirements of safety applications. We focused particularly on offering a reliable and fast data dissemination solution for Vehicle-to-Vehicle communication. We propose two range adaptive broadcast variations that can accurately estimate radio characteristics and transmission range. The results of the simulation indicate that we could increase delay performance while retaining network coverage.

Redundant Broadcast suppression is a critical component in multi-hop vehicular broadcast protocol because it results in an exponential increase in unwanted broadcast if ignored.This leads to the broadcast storm problem. We began by analyzing existing techniques for broadcast mitigation in VANETs in order to identify the most efficient approaches with regard to redundancy reduction. We discovered that there are many different schemes to address redundancy, but probability and delay-based broadcast schemes are the most suitable and widely used in literature due to features such as simple implementation, high coverage, less processing delay, and so on. In terms of redundancy, probability-based schemes are inferior due to high redundancy and delay. In view of the above facts, we have selected delay based broadcast as the base methodology for the proposed work.

Existing delay-based protocols use a fixed transmission range for the calcu-

lation of deferred time for broadcast. This results in a certain minimum delay, irrespective of network load conditions. We introduced dynamic deferred time selection by using perceived transmission range and channel quality parameters. The Adaptive Range-based Broadcast (ARB) uses perceived transmission range as a key parameter in the delay calculation process. The Efficient and Reliable Data Broadcast (ERDB) scheme increases reliability and stability by incorporating the channel quality parameter in delay calculation.

The performance evaluation is done through simulation work. The majority of the vehicular network research approach uses simulation because of practical and cost limitations. We defined three performance metrics to evaluate the findings. namely, coverage (%), average delay, and average hop count. For the simulator framework, we used *NS3* as a network simulator and *SUMO* as a traffic and mobility simulator. Both of these simulators are open-source and have wide acceptance among researchers.

Application Scope: All the safety-related applications are crucial in the sense that faster dissemination of safety alerts can give drivers more time to take corrective action. Plus, safe transportation requires cooperation among all As a result, safety alerts must provide high coverage on networks. In this sense, the proposed work meets the basic requirements of safety-related ITS applications. Because delay-based broadcast schemes generate very little overhead, the proposed work is applicable to many non-safety applications in addition to safety applications.

6.1 Future Work

Here we highlight a few research directions to improve our protocol. The extension of the work may come through adaptation as per the required criteria and the incorporation of new technology.

1. *Adaption to non-safety applications:* Normally, non-safety applications follow a pull-based communication model. In which, depending on the requirements, users request specific data and receive a response. When compared to safety-oriented applications, these applications are more delay-tolerant. So

a multi-hop request-reply type of routing strategy can be framed to address the routing solution for convenience applications.

2. *Message priority based communication:* To broaden the application scope toward non-safety applications, message priority-based queuing can be added to this protocol as well.

3. *Addition of V2I communication* The proposed research work is implemented on fully connected networks. To improve protocol performance at extremely low node densities, limited or full-scale vehicle-to-infrastructure support can be added.

4. *Internet of Vehicles:* The advancement of communication technology and embedded hardware has resulted in a revolution in the transportation industry. The next era of vehicular ad hoc networking will be called the "internet of vehicles." All vehicles in the IoV are linked by multiple communication technologies, applications, and users. The first step in this direction is to incorporate other communication technologies along with the IEEE 802.11p-based network to make it a hybrid network.