PERFORMANCE ANALYSIS OF ADAPTIVE DATA DISSEMINATION IN VEHICULAR NETWORKS

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Summary

CHAPTER 1: Introduction

According to statistics from the automotive industry, as of 2022, there were about 1.446 billion cars in the world. It means that approximately 17.7 percent of people own a car. Although the widespread use of automobiles has made transportation more convenient, it has also led to an increase in traffic fatalities, congestions, environmental pollutions, etc. However, this fatality, economic and environmental damages can be avoided by using the intelligent transportation system (ITS) Through the use of wireless communication and diverse sensors, ITS enhances traffic safety. In addition to enhancing traffic safety, processing real time information offers a number of additional advantages for vehicle networks. Particularly, vehicular ad hoc networks (VANETs) are regarded as the most prominent technology for ensuring and maintaining a vast array of applications, ranging from road safety and traffic control to infotainment.

CHAPTER 2: Vehicular Ad hoc Networks

Vehicular Ad-hoc Networks (VANETs) are self-organizing networks that enable information exchange among moving vehicles without the need of any central coordination. VANETs have characteristics that distinguish them from standard wireless networks and make them useful for dynamic traffic scenarios. Some of these properties include, but are not limited to, maintaining connectivity despite high mobility, requiring no central coordination, supporting single-hop and multi-hop communications, etc. On the other hand, obstructions, a shorter communication range, and limited bandwidth resources are some of the limitations VANETs have.

CHAPTER 3: Data dissemination in Vehicular Networks

One of the key design aspects of vehicular communication systems is data dissemination, which is the process of distributing and pushing data to network nodes. The source data or message can be distributed in one-to-one, one-to-any, or one-to-all modes. In the networking aspect, these three schemes are defined as unicast, anycast, and broadcast modes of communication. In unicast mode, data transmission occurs from a single source to a single destination node. Anycast is a one-to-any kind of transmission in which data is sent to any nodes in the area of interest (AoI). Broadcast is a very native data dissemination scheme in which the source node sends the data to all surrounding nodes. Flooding is the simplest method for performing multi-hop broadcasting. However, excessive redundancy and packet collisions are the main drawbacks of simple flooding. Controlled-flooding techniques are a preferable choice for implementing safety applications; however, these approaches have many challenges. This chapter represents different multi-hop safety message broadcast schemes that are designed to avoid the broadcast storm problem and establish reliable and efficient safety message dissemination in vehicular environments.

CHAPTER 4: The proposed approach

In our proposed approach, we are aiming at achieving three main objectives: scalability, reliability, and delay efficiency. To achieve scalability, we address the broadcast storm problem in large-scale scenarios, such as high-density traffic regimes. The scalability at large scale vanet scenarios is achieved by efficient redundancy reduction method. The reliability of the protocol is achieved by using current signal characteristics along with other parameters. A reduction in congestion-induced packet drops improves the delay characteristics of the protocol. Adaptive Range based Broadcast (ARB) and Efficient and Reliable Data Broadcast (ERDB) are the two protocols proposed in this chapter.

CHAPTER 5: Performance Evaluation

Extensive simulations are conducted for the proposed work. Network Simulator 3 (NS3) is used for network simulation, while Simulation of Urban Mobility (SUMO) is used to generate mobility traces on a real road network. Different mobility patterns and vehicle densities are considered for evaluating performance of proposed work. For comparison, two existing protocols, flooding and slotted 1-persistent broadcast, are recreated in the same environment. In order to measure the performance of proposed approaches, three performance metrics: *coverage, mean delay,* and *number of hops* are defined. The performance of the proposed protocols are assessed on highway and urban topologies.

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 based data dissemination strategies that fulfil 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.

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.