Chapter 11
A Survey on Information Dissemination in VANETs

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ABSTRACT

Vehicular Ad Hoc Network (VANET) has become an active area of research, standardization, and development because next generation vehicles will be capable of sensing, computing, and communicating. Different components in a vehicle constantly exchange available information with other vehicles on the road and cooperate to ensure safety and comfort of users using VANET. In VANET, information like navigation, cooperative collision avoidance, lane changing, speed limit, accident, obstacle, or road condition warnings, location awareness services, etc. play a significant role in safety-related applications. Safety related information dissemination is challenging due to the delay-sensitive nature of safety services. In this chapter, the authors survey some of the ongoing recent research efforts in information dissemination in VANETs. They also outline some of the research challenges that still need to be addressed to enable efficient information dissemination in VANET.

INTRODUCTION

A Mobile Ad-Hoc Network (MANET) is comprised of a group of mobile nodes without fixed communication infrastructure. The network has the capability of self-organization in a decentralized fashion. A Vehicular Ad Hoc Network (VANET) is an example of a MANET where the mobile nodes are vehicles. Communication is possible between vehicles within each other’s radio range as well as with fixed roadside infrastructure components. VANET concept is an integral part of the Intelligent Transportation System (ITS) architecture, which aims to improve road safety, optimize traffic flow, reduce congestion, and so on (Manvi, et al., 2008; Boukerche, et al., 2008).

The key differences of VANET as compared to MANET environment are as follows:

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Components building the network are vehicles, restricted mobility constraints, extremely high mobility and time-varying vehicle traffic density, most of the vehicles provide sufficient computational and power resources, thus eliminating the need for introducing complicated energy-aware algorithms, vehicles will not be affected by the addition of extra weight for antennas and additional hardware.

VANET raises several interesting issues with regard to Media Access Control (MAC), Mobility management, Data aggregation, Data validation, Data dissemination, Routing, Network Congestion, Performance analysis, Privacy, and Security.

With the increase of portable devices as well as progress in wireless communication, VANET is gaining importance with the increasing number of widespread applications. Some of the important applications of VANETs are as follows:

1. Message and file delivery,
2. Providing location-dependent services like the location of the nearest facilities like fuel stations, parking zones, entertainment places, and restaurants, etc.,
3. Internet connectivity,
4. Information and warning functions,
5. Dissemination of road information (including incidents, congestion, surface condition, etc.) to vehicles distant from the subjected site,
6. Co-operative assistance systems,
7. Traffic monitoring and management services,
8. Other advanced services like interactions between VANET nodes and the road infrastructure, for example traffic calming measures (including automatic speed limiters), intelligent road signs, tolling (congestion charges for entering urban areas at peak times, cargo monitoring, etc.).

VANET architectures for vehicular communication may be classified into three types: purely ad hoc based, infrastructure based and hybrid type. In the purely ad hoc based VANET architecture, Vehicle to Vehicle (V2V) communication exists without the infrastructure. In the infrastructure based VANET, communication is possible in between vehicles using infrastructure (V2I) such as base stations or access points on the road. Combination of V2V and V2I architectures leads to the hybrid mode of VANET.

Data dissemination is an important feature of VANET. Vehicles must be able to communicate with each other so as to ensure that safety and traffic management applications can function successfully. In a hybrid VANET environment where heterogeneous access technologies are available, the manner in which information is propagated between the vehicles within short time is a major issue. The aim of data dissemination is to transport information to the specific vehicles while meeting a number of constraints. The information saturation time, lifetime of the data and reliability of its transportation across the vehicular system are some of the major considerations.

This chapter is organized as follows. The first section of the chapter explains the concept of data dissemination in VANETs and its importance and provide taxonomy for various dissemination methods. The following section presents various techniques for data dissemination in VANETs. Security and Privacy threats concerned to the information dissemination are subsequently discussed. The last section brings out future scope of research after highlighting the performance characteristics.

**DATA DISSEMINATION IN VANETS**

Data dissemination can be defined as broadcasting information about itself and the other vehicles. Each time a vehicle receives information broadcast by another vehicle, it updates its stored information accordingly, and defers forwarding the informa-