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An Intelligent Traffic Management and Accident Prevention System based on VANET

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Abstract: ***The vehicle population increases daily which leads towards accidents. So to overcome this issue, Vehicular Ad Hoc Network has come with lot of ideas such as vehicular communication, traffic controlling and navigation. In this project, we are focusing on accident prevention and traffic signal control for ambulance and normal vehicles. To do this, we have implemented a highway and intersection model that manages vehicle mobility. It shows the actual vehicle to vehicle and vehicle to infrastructure communication. This is implemented by modeling the road side unit, traffic control unit, and onboard unit along the roadside in the Network Simulator 2 simulation software. In the simulation, the parameter like end-to-end delay, packet delivery ratio, throughput and packet lost are measured. These parameters ensure efficient communication between the vehicles. This in turn improves the road safety, since the vehicles will be notified about the other upcoming vehicles in their vicinity.***

Keywords: accident prevention, vehicle to vehicle, vehicle to infrastructure, efficient communication

1. Introduction

Vehicular Ad Hoc Network (VANET) is a promising approach to facilitating road safety, traffic management, and infotainment dissemination for drivers and passengers. Vehicular Ad Hoc network are receiving a lot of attention due to the wide variety of services they can provide.

The main goal in the design of such networking is to achieve vehicle-to vehicle and vehicle-to-roadside unit wireless communication. Using On Board Units vehicles can communicate with each other as well as with road side. Units (RSUs) located at critical points on the road. A self organized network can be formed by connecting the vehicles and RSUs, called a vehicular ad hoc network (VANET), and the RSUs are further connected to the backbone network.

In this paper we present a VANET based vehicle to vehicle and vehicle to infrastructure based road traffic control system which can collect traffic information from individual cars and share the road traffic information over a wide area network to control the traffic signaling cycle. In the current road traffic signaling systems road side sensors are used in some busy locations of cities to estimate traffic arrivals which provide a very limited snap shot of the total traffic scenario [2].

2. Literature Survey

Several techniques were invented by different researchers to overcome and to manage the traffic issues. Ali Rakhshan, Donald L. Fisher and Mohammad Nekoui works on tuning collision warning algorithms to individual drivers for design of active safety systems. Their paper deals with the development of safety systems for vehicular Ad Hoc Networks. In recent years, collision warning system have been developed to help mitigate rear-end collision. However, these types of systems generally rely solely on the distribution of the entire population of drivers, thereby ignoring the distinct characteristics of individual drivers [3].

E. A. Donato and G. Maia give brief knowledge of impact of 802.11p channel hopping on VANET communication protocols. VANETs are specific type of moving networks in which the nodes are vehicles with processing, storage and wireless communication capacity. The wireless access in vehicular environments presents architecture, based on a division into multiple channels with each channel set certain types of application and that uses a switching mechanism for the selection of channels, since only one channel is active at a given time. However, in certain scenarios, this channel switching mechanism approach used in wave introduces an undesirable effect that allows different vehicles to transmit simultaneously, resulting in collisions [4].

Xiaoxiao Jiang and David H. C. Du proposed a system on a bus vehicular network integrated with traffic infrastructure. In their paper, they propose a new two tier bus VANET the fully integrated with traffic infrastructures for improving the performance of VANET. They take advantage of RSUs and TCC that already required and constructed by ITS and investigate how much benefits they can obtain form this realistic environment. By integrating RSUs and TCC with buses, the coverage of the high tier nodes can be ensured and the possibility of packets carrying is reduced. TCC helps us quickly identify the location of the destination vehicle. Comparing to traditional VANET, better performance of our BUS-VANET can be achieved with less delivery delay and higher delivery rate [5]. U. Kumaran and Dr. R. S. Shaji works on vertical handover in vehicular ad hoc network using multiple parameters. In their work they compared single criteria decision marking, multi-criteria may increase the handover delay as it considers several parameters to decide the handover. Number of handover is a fundamental parameter in handover due to resource management. Unnecessary handover may reduce the network performance in terms of throughput and network occupancies. However, the implementation of multi-criteria decision making in the vertical handover decision algorithm of a vehicular ad hoc network increases the network performance in terms of number of hand off and load balance index [6].

3. VANET based traffic control system

The VANET is specially categorized for the short range communication among the roaming vehicles as well as between the vehicles and the road side information infrastructure. Usually, the moving vehicles are equipped with On Board Unit (OBU) and the road side communication infrastructures are referred to Road Side Units (RSUs). For the wireless access in the vehicular environment the new WLAN standard IEEE 802.11p was developed which is also referred to as Dedicated Short Rand Communication (DSRC) that offers strong baseline for the V2V and V2I communication. The licensed spectrum of 75MHz has been allocated at 5.9GHz for the DSRC. The physical layer of the IEEE 802.11p is similar to the IEEE 802.11a standard.

Following figure shows the general overview of Vehicular Ad Hoc Networks (VANET).

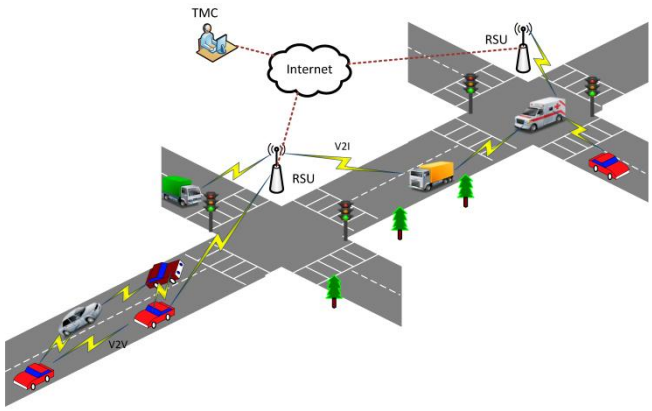

Figure 1: Working principle of VANET

VANETs are self organizing communities of wheeled mobile units consisting of large number of trucks, cars, buses and a small number of static infrastructure nodes such as traffic signals, highway rail grade crossings, and informational signage within radio communication range to each other. Two basic approaches suggested to establish inter vehicle communication (IVC) in the VANET at the physical layer are based on some variant of current wireless LAN technology (WLAN) such as the 802.11 family, Bluetooth, or extensions of 3G telecommunications protocols such a reservation based ALOHA, ULTRA (Universal Terrestrial Radio Access) etc. The preferred method for traffic information dissemination in a VANET is broadcast routing, with otherwise reduced bandwidth consumption. Several information propagation schemes have been proposed for VANETs.

4. Methodology

In this project, we propose a basic warning advertisement system based on the use of 802.11p standard. The target is to send vehicle safety message with high reliability and low delay. We evaluated the performance of our proposed system. We also concentrated on several important issues related to traffic safety such as the propagation delay of warning messages in an urban environment, the number of blind vehicles, and the total number of packets received by each vehicle.

For our warning advertisement system we picked IEEE 802.11p technology because it is expected to widely adopt by the industry. Moreover, we consider this technology is able to offer good performance in environment where the physical layer properties are rapidly changing and where very short duration data exchanges are required.

5. Performance Parameters

Following are the performance parameters which are taken in consideration.

Table 1: Performance Parameters

Parameter	Value
Number of nodes	171
Maximum speed of vehicle	5-50m/sec
Scenario size	3500 x 2000m
Distance between streets	50m
Normal Packet size	512B
Warning Packet size	256B
Simulation time	200 sec
Sensor transmission range	100m
Vehicle transmission range	250m

6. Simulation Results

The simulation results presented in this project were obtained using the NS-2 simulator. We evaluated the following performance parameters: (1) Packet send, (2) Packet received, (3) Packet Delivery ratio, (4) End-to-End delay, (5) Packet loss, (6) Throughput.

Table 2: Varying Parameters

Parameters	Data Rate	Packet Size	Speed	No. of Vehicles
Packet Delivery ratio (%)	98% - 99.2%	99.2% - 99.7%	98% - 100%	99.2% - 100%
Packet Loss (Bytes)	< 3.4	< 4	< 4	< 1.2
End-to-End Delay (ms)	< 18 ms	< 18 ms	< 75ms	< 5.5ms
Throughput (Kbps or Mbps)	1.6 Mb/s	104 Kb/s	10-65 Kb/s	15-100 Kb/s

Following figure shows the output performance of the parameters

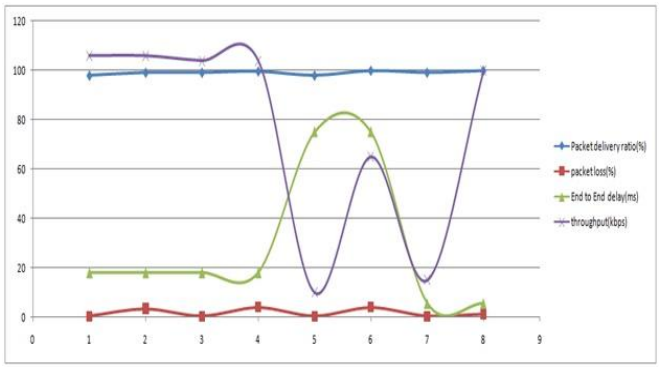

Figure 2: Performance factor Vs Control factors

From above overall output graph we get,

a) **Packet Delivery Ratio (PDR):** It is the ratio of the number of delivered data packet to the destination.
Note: The greater value of PDR means the better performance of the protocol.

b) **End-to-End Delay:** It is the average taken by data packet to arrive in the destination.
Note: The lower value of end to end delay means the better performance of protocol.

c) **Packet loss:** The total number of packet dropped during the simulation.
Note: The lower value of the packet lost means the better performance of the protocol.

d) **Throughput:** It is the amount of data received by destination.

7. Summery

- The proposed system has closed performance with lower delay and higher PDR which are important parameter of system.
- The advantage provided by the application is higher when there are more vehicles in the road network with average speed.
- Proposed system can used to enhance the quality of vehicular services in VANET environments.
- We conclude that VANET technology will lead to improved traffic efficiency, resulting in decreased travel times and safer driving.

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