Asian Journal of Engineering and Applied Technology
ISSN: 2249-068X (P) Vol. 1 No. 1, 2012, pp.19-21

DOI: https://doi.org/10.51983/ajeat-2012.1.1.2505

Study of V2V Communications on Mumbai-Pune Express Highway

Vaishali D. Khairnar[1] and S. N. Pradhan[2]

[1]Department of Information Technology, Terna Engineering College, Navi Mumbai - 400 206, India
[2]Institute of Technology, Nirma University, Ahmedabad - 382 481, India
Email:- Khairnar.vaishali3@gmail.com, snpradhan@nirmauni.ac.in
(Received on 24 December 2011 and accepted on 18 March 2012)

Abstract **- This paper presents a detailed study of short range communications between vehicles in a realistic Mumbai-Pune Express (MPE) highway scenario. This paper will show the expected wireless communication characteristics in a vehicle driving environment and identify the factors that significantly affect V2V communication performance. It is also illustrated to broadcast different emergency messages according to the different factors identified (e.g. whether, road condition, vehicle traffic emergency message to avoid collision etc.).**

Keywords **: V2V, MPE, 802.11p, Multi-hop Communication**

I. Introduction

In-depth knowledge and understanding of V2V communication characteristics in Vehicular Ad-hoc Network (VANET) environment is needed to provide the groundwork for realizing reliable vehicle communication services for travelers. Vehicular communications are distinct from other types of wireless communications due to high mobility of vehicles and the environment in which they operate. There has been some initial work in measuring the performance of Vehicle-to-Vehicle (V2V) communications measured the performance of V2V 802.11b and 802.11e communications [1-4]. Categorized operating environments as suburban, urban and freeway and reported the communication performance. TCP/UDP performance of a vehicle driving by a roadside WLAN access point [5]. Above two efforts focus on single-hop communications [6]. Demonstrated multi-hop V2V communications. These studies do not attempt to relate the vehicular environment to communication performance.

In this paper, we present a detailed measurement study in a realistic express highway environment. Instead of covering many different areas [3], experiments were constructed on a particular area, which allow deeper knowledge and understanding of specific factors affecting V2V communication performance. Single hop experiments are used to characterize V2V communications and identify factors that affect communication performance. Then we demonstrated how multi-hop communication can help and overcome the obstacles presented by the physical environment.

II. Experimental Design

An experiment has been performed on vehicle to vehicle communication on Mumbai-Pune Express Highway (MPEH) by using Traffic Simulator (SUMO) and Network Simulator (NS-2.34).

For this experiment we used a Fedora 12 OS on which we have installed traffic and network simulator. In traffic simulator we created vehicles running on MPEH and with NS-2.34 we can have communication between vehicles using 802.11p [1-3] with an 2.5 dB omni-directional antenna and a GPS receiver (Gramin), DSRC transceiver and in-vehicle sensor. The radio transceivers are configured to work with ad-hoc network. GPS reports the latitude, longitude, speed of the vehicle for every 2 seconds. The location information reported by the GPS has an accuracy of 5-7 meters. We also obtained location information for every second. GPS readings helps in network performance measurement. All V2V communications were conducted using emergency broadcast at 2Mbps that allows us to explore basic communication performance because there is no RTS/CTS/ACK and retransmissions.

Fig. 1 Mumbai-Pune Express Highway Road illustration

All the participants log time, location, velocity, data packets received/sent, and signal quality. All logs are associated and parsed together to obtain the results presented in this paper.

The experiment is conducted on MPPEH from Panvel-Bypass to Lonavala which is 50 KM long as shown in fig.1. This express highway has total six regular lanes and two tunnels in our study area. Vehicle traffic in opposite directions is separated by a concrete median barrier. We believe this configuration is typical in India. All experiments are conducted between 7am to 11pm and 6pm to 8pm under congested and whether conditions.

III. Single-Hop Communications

V2V communications were measured between one vehicle following another vehicle. Major metrics measured is success ratio, which is defined as the fraction of packets transmitted by sender that are successfully received by the receiver.

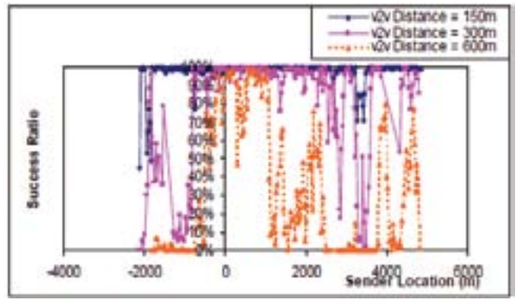

Fig. 2 Communication Performance between two vehicles over sender locations when vehicles are moving in north direction (i.e. towards Pune)

V2V communication performance depends on inter-vehicle distance as shown in fig. 2. The communication is nearly perfect when two vehicles are within 100m and within 300m except some dips corresponding to express highway curves. On the other hand the communication ranges upto 600m in some areas where the express highway is straight and free of obstacles.

IV. Broadcast E&W Message

V2V communication may be beneficial, wireless communication is typically unreliable. Many factors, for example, channel fading, packet collisions, and communication obstacles, can prevent messages from being correctly delivered in time [7]. In addition, ad hoc networks formed by nearby vehicles are quite different from traditional ad hoc networks due to high mobility of vehicles. Using V2V communication, when a vehicle on the express highway road acts abnormally, e.g., deceleration exceeding a certain threshold, dramatic change of moving direction, major mechanical failure, etc., it becomes an abnormal vehicle. An abnormal vehicle generates Emergency Warning Messages (E&WMs), which include the geographical location, speed, acceleration and moving direction of the abnormal vehicle, to warn other surrounding vehicles.

On the other hand, the average end-to-end delay as shown in fig. 5 remained in approach by the routing protocol with variation by AODV in high density model.

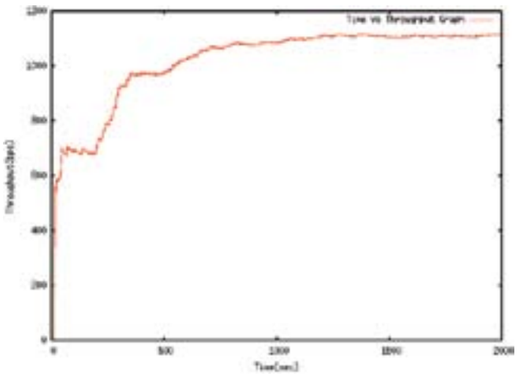

Fig.3

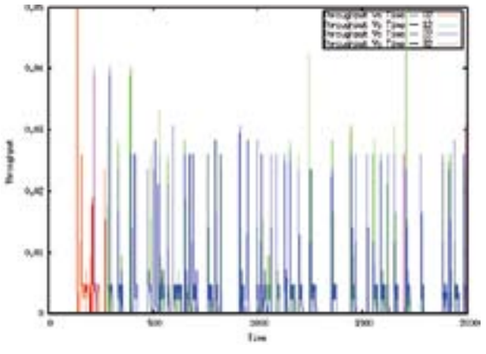

Fig. 4

Fig. 3 & 4 shows V2V communication throughput against different nodes and different pause time. It is also identified that packet deliver ratio is 59% for DSR routing protocol which is more suitable for VANET.

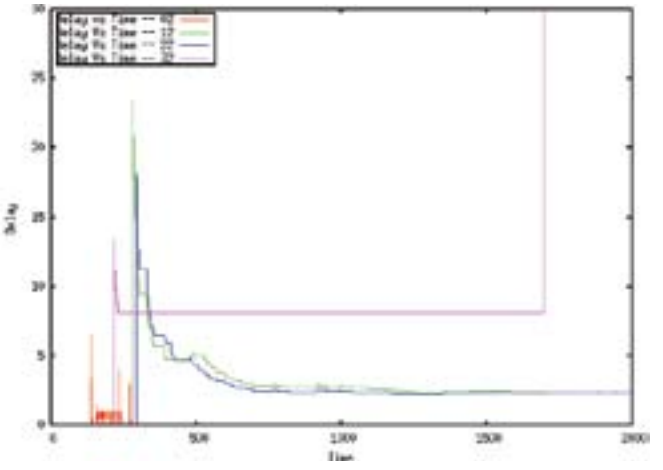

Fig. 5 An average end-to-end delay

V. Conclusion

In this paper, we have presented our experiment using simulators with short range of communications between vehicles for Mumbai-Pune Express Highway realistic scenario using AODV and DSR routing protocol. Similar studies can be conducted for broad range of settings (e.g. different packet size, different locations etc.) which will give more understanding.

References

[1] S. Rezaei, R. Sengupta, H. Krishnan and Xu. Guan, "Reducing the Communication Required by Dsrc-Based Vehicle Safety Systems", *VANET workshop, IEEExplore* Oct. 2007.

[2] Y. Toor, M.Paul snf I.A. Laouiti, "Vehicle Ad-hoc Networks: Applications and Related Technical Issues", *IEEE Communications Surveys,* 3rd Quarter 2008.

[3] J.P. Singh, N. Bambos, B. Srinivasan, and D. Clawin, "Wireless LAN Performances Under Varied Stress Conditions in Vehicular Traffic Scenarios", *IEEE VTC 2002.*

[4] Nathan Balon, "Increasing Broadcast Reliability in Vehicular Ad Hoc Networks", 2006.

[5] J. Ott and D. Kutscher, "Drive-thru Internet", IEEE 802.11b for Automobile users in INFOCOM 2004.

[6] M. Moske, H. Fubler, H. Hartenstein, and W. Franz, "Perfomance Measurements of a Vehicular Ad-hoc Network", . VTC 2004.

[7] Xue Yang, Jie Liu, Feng Zhao and Nitin H. Vaidya, "A Vehicle-to-Vehicle Communication Protocol for Cooperative Collision Warning", *IEE Explore 2004.*