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Vehicular Adhoc Network to Support Traffic Safety on Highways

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***Abstract*:** The presence of Road Side Unit (RSU) is helped network payloads to be extended to other nodes which is already far from recurrent node coverage. We proposed using the mobile node to act as Road Side Unit (RSU) and perform data packet routing as Road Side Unit (RSU) does. The main problem of using large number of Road Side Unit (RSU)s is performance degradation be consumption of large time for data delivery. In this paper, we attempted using different number of mobile nodes as Road Side Unit (RSU)s which is differs from classical Road Side Unit (RSU)s as the last is static and other is dynamic (in motion). Outcomes of this study shown that large number of mobile nodes as Road Side Unit (RSU)s may enhance the connectivity by reducing the link re-healing time and maintaining the connection for longer time.

Keywords. *VANET, MANET, RSU, TCP, UDP, Routing, Traffic.*

I. INTRODUCTION

Internet and data exchanging networks are made to facilitate people's lives where people can share data such as important text messages, locations and geographical data, finical news and business-related information. It is seen for last three decades that individuals were able to communicate with each other much easier with presence of internet network. Internet had provided that facility to link people and permit them unlimited data sharing capability [1]. One more challenge was raised after the popularity of internet network which related to the mobility of users, as they demanded to have free to move facility while connecting the internet. That posed big challenge for network engineers before they proposed what so called cellular communication network or mobile cellular network. This kind of network was earlier developed to provide phone calls and short text messages facilities to their users. Hence after, cellular network is becoming more useful after providing the internet facility to their users [2]. The concept of cellular communication can be descripted more likely as several base stations or network service providers exhibiting a particular, known and limited place. The coverage of this network is limited to the number of those slots (areas) that being used to propagate the base stations towers. In other word, cellular network is covering set of geographical areas called as cells and permit transmission of data through those cells [3].

Soon after, the demand is increased for a network to perform particular and specific task more likely to exchange safety messages or to share the sensing information. Such network is known as adhoc networks. It formed the infrastructure to many applications such as Vehicle Adhoc Network (VANET), Mobile Adhoc Network (MANET), flying adhoc network, sensor network, etc.

Vehicle Adhoc Network (VANET) is exploited for implementing special network for traffic safety insurance. Each node of this network is moving on some road and collecting information related to traffic condition, traffic accidents and alarm signaling, that information are being exchanged amongst the mobile nodes where each driver will get real-time update about the traffic information.

Network is consisting of two major sections, the ground nodes (mobile nodes) and the Road Side Unit (RSU)s or infrastructure unit (as termed by many researcher). Communication which begin between the nodes themselves is termed as node to node link whereas communication between the Road Side Unit (RSU) and nodes is termed as node to infrastructure link.

Road Side Unit (RSU) is defined by many research papers as intelligent traffic system used to facilitate the network payload transmission between nodes. Basically, nodes are sending information to each other in form of warn message to alert drivers of accidents coexistence. This paper is involved attempt for using different number of mobile nodes as Road Side Unit (RSU)s which is differs from classical Road Side Unit (RSU)s as the last is static and other is dynamic (in motion).

II. MOBILE ADHOC NETWORK (MANET)

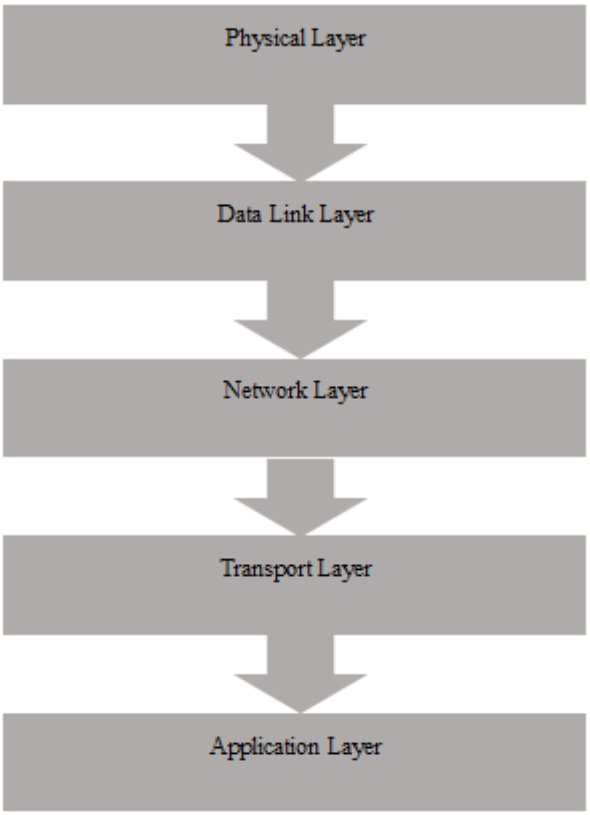

Figure 1. Adhoc network functional layers.

Mobile Adhoc Network (MANET) is evolved network technology that established to exchange data in small scale distances. However, this technology is introduced mostly in two standards namely: wireless sensor network and wireless

vehicle network; the both network standards are infrastructure by adhoc network standards. Ad hoc is regular network standard which is similar to any other data exchanging network. It consists of five functional layers as shown in Figure 1. [8]

As application of mobile wireless network, adhoc network is more adoptable standard that serves plenty of applications. The demand increased for a network facility with lesser cost to link the vehicles while it travels in high ways. This network called as Vehicle Adhoc Network (VANET), and differs from the popular standards such as cellular network by its simplest and easy to adopt infrastructure, lower cost (free at most) and also by its efficiency [10].

Vehicle Adhoc Network (VANET) is dedicated to support the intelligence transportation system by providing the same with important data about the traffic in the high ways. The mobile cellular network is and other wireless standards are mainly differing from wireless Mobile Adhoc Network (MANET) in the many concerns. Vehicle Adhoc Network (VANET) is basically formed of the cars which are moving in high ways so that, cars can communicate with each other sharing the traffic status in that road. Saying that one car had crashed at somewhere in the road and the place of crashing is more susceptible to affect the other cars which are coming forward without knowing the situation. In other word, more cars can be involved in such accident when they drive in high speed as illustrated in Figure 2.

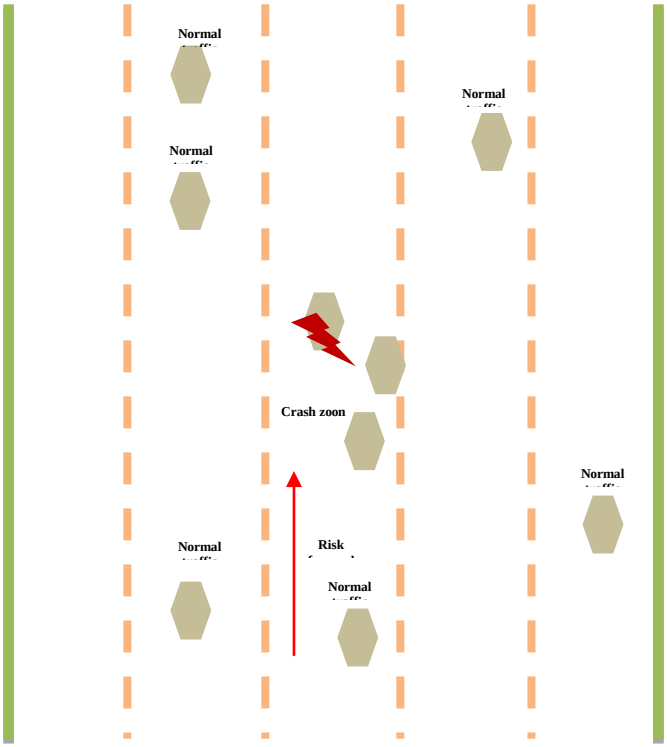

Figure 2. Traffic condition depict the accident scenario.

III.EMPIRICAL MODEL

We proposed using the mobile nodes are Road Side Unit (RSU) to support the network, in this proposal, node can reach easily to large coverage and also can convey the message in more rapid fashion. The objectives now is to reduce the re-healing time and to reduce the time delay. The study is further proposed using various number of relay nodes and calculate the effects of that on the mentioned performance metrics. Figures 3 to 5 demonstrate the models proposed in this study.

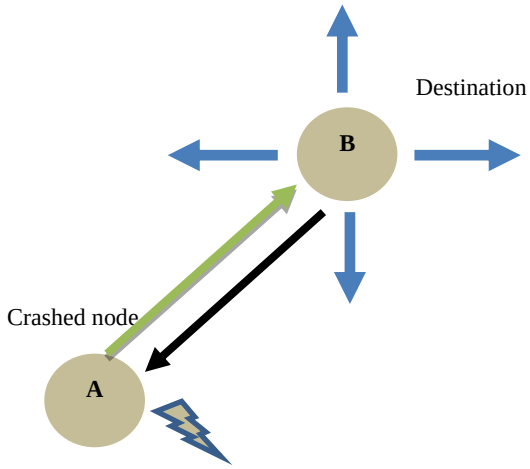

Figure III. First simulated model.

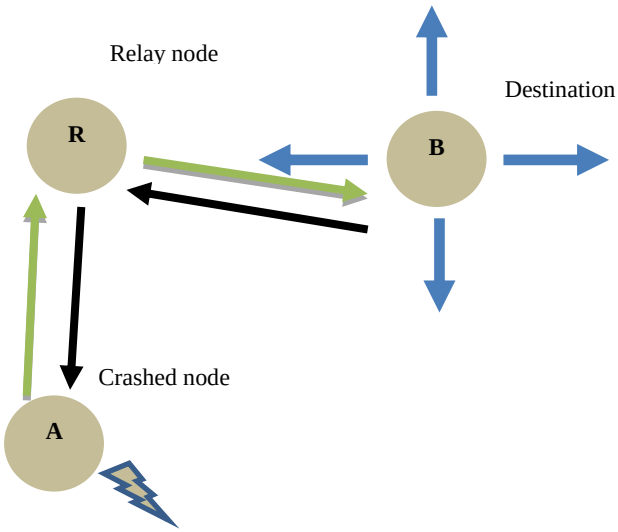

Figure 4. Second simulated model.

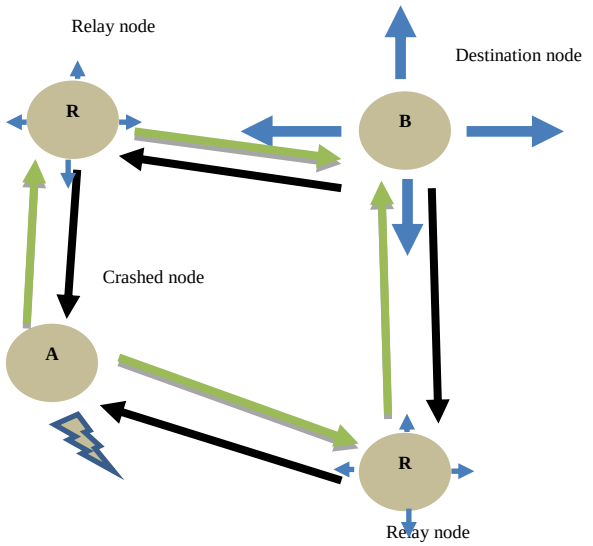

Figure 5. Third simulated mode topology.

The network topology and structure can be detailed in Table 1.

Particle	Details
Number of mobile nodes	1
Number of relay nodes	1, 2, 3
Motion of mobile (*destination node)	Random
Motion of relay node	Random
Speed of nodes	40 km/h

Topology size	300 m x 300 m
Radio range of any node	150 m
Routing protocol	AODV

IV. Study Outcomes

As four network model are set in Network Simulator NS-II, every model was treated individually, the calculations efforts made in every model attempting to evaluate the time delay and re-healing time. The results of the so called the link duration between the source node and destination node are represented in Figures below.

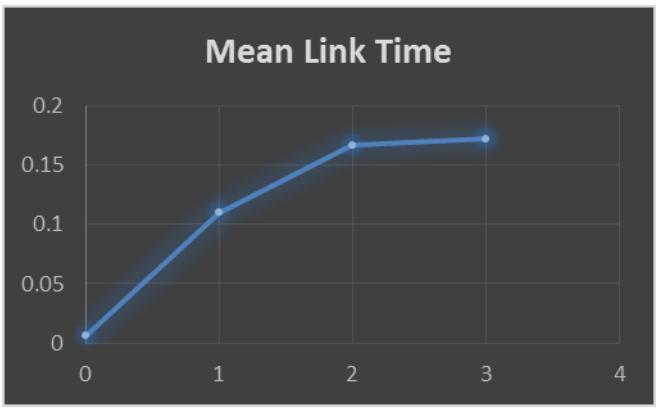

Figure 6. Mean link duration of the four models.

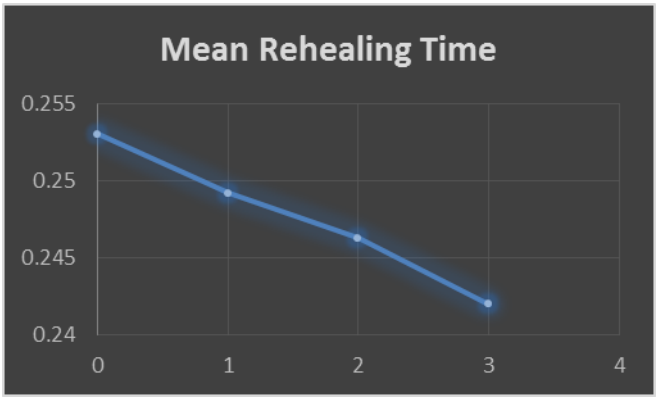

Figure 7. Mean re-healing time of the four models.

CONCLUSION

In this study, mobile vehicles are randomly moving in the high ways and hence in case on car crashing, car will assume stopped and the place of crashing is susceptible to intake more than one vehicle. As vehicles are being droved in high speed and drivers; due to their unawareness of accident zoon, they can get into it and hence problem is enlarging. On the other hand, adhoc network is attempting to share safety norms to the inward drivers to avoid the crashing in that particular location. For some reasons more likely due to car limited radio converge and speed of the cars running on the high way, the reachability of this message is critical and hence, network further development was mandatory.We treated the mobile vehicles as relay in other word as Road Side Unit (RSU) which convey the crashed car messages to the far most hosts in the network as an attempt to ensure rapid ambulances and to prevent further losses. For that, we tried using different number of more likely no relay, one relay, two and three relays and hence we calculated the link duration between source node and destination node and the time taken by the nodes for reconnection after link goes down. The observations made from this study is increment of relay nodes may help to maintain the link between source and destination for longer time and reduce the time required to reconnect the nodes if that links goes down due to nodes speed or any other event.

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