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Performance Analysis of AOMDV and AODV Routing Protocol for Emergency Services in VANET

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ABSTRACT

VANET has become a key for fast growing wireless applications now a day. Researchers has proposed many applications based on existing protocol either location or topology based to measure the various performances merits. The two major routing protocol widely used by VANET are: AODV and AOMDV (multipath) is extension of AODV (single Path) which consider the intermediate participant node to reach the destination whereas in AODV single dedicated path is provided. In case of emergency AOMDV search the alternate route to find the destination and in AODV this option is not available. In many new applications like traffic management and Emergency rescue operations or any other user specific application this protocols is widely used in recent research. In our proposed network we have applied both the above said routing protocol and analyze performance for both the protocols. In this paper performance merits like PDR, PLR, E2E and Throughput has been evaluated and their relative comparison for both AOMDV and AODV routing protocol has been obtained. The result was obtained on NS2.34 simulation platform. These results help us to evaluate comparative performance of both the existing protocols for different city scenario with changing topography and traffic density in the network. Based on these results much user specific application can be developed to find appropriate routing protocol for the network under design.

Keywords: Ad Hoc On-Demand Distance Vector (AODV), Ad hoc on-demand multipath distance vector (AOMDV), Vehicular Ad hoc Network (VANET), Emergency Services
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INTRODUCTION

Now a day due to heavy traffic on busy road has increased accidents in peak hours. This situation has becoming worst day by day. As a result, people are losing their life every second. These networks are uncontrollable and risk of life is also a major issue to overcome such situations network can be well organized to avoid traffic jams, unexpected incidents and reduce long delays. If the vehicles are informing timely about the various situation dynamically in advance. This will help to improved safety and efficiency of the network. VANET is a self-organized network aiming to provide safety and solution to various traffic management systems. In recent research it becomes a key component in intelligent transport system.

As vehicles are highly mobile in nature they itself can provide the various scenarios of traffic by exchanging the information among themselves. In this paper we were trying to analyze the network with the help of two existing routing protocol AODV and AOMDV. For rapidly changing network topology and variation in communication connectivity has become a difficult task for routing protocols in VANETs. Also this routing protocol should be reliable and dynamic to varying network load. To design more realistic mobility model we have considered city scenario that pose the fast changing topology to evaluate performance. The Figure 1 shows the city scenario which we have considered for a simulation network. This network provides two types of connectivity Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) over a wireless communication standard IEEE 802. 11p.This helps Road Side Unit (RSU) to broadcast emergency message received from adjacent node or vehicle from the network.

The paper is discussing the content related work of existing routing protocol in network simulation model, the methodology and implementation of proposed work, Routing protocol and performance parameters used for evaluation and brief about obtained simulation results and their comparative analysis.
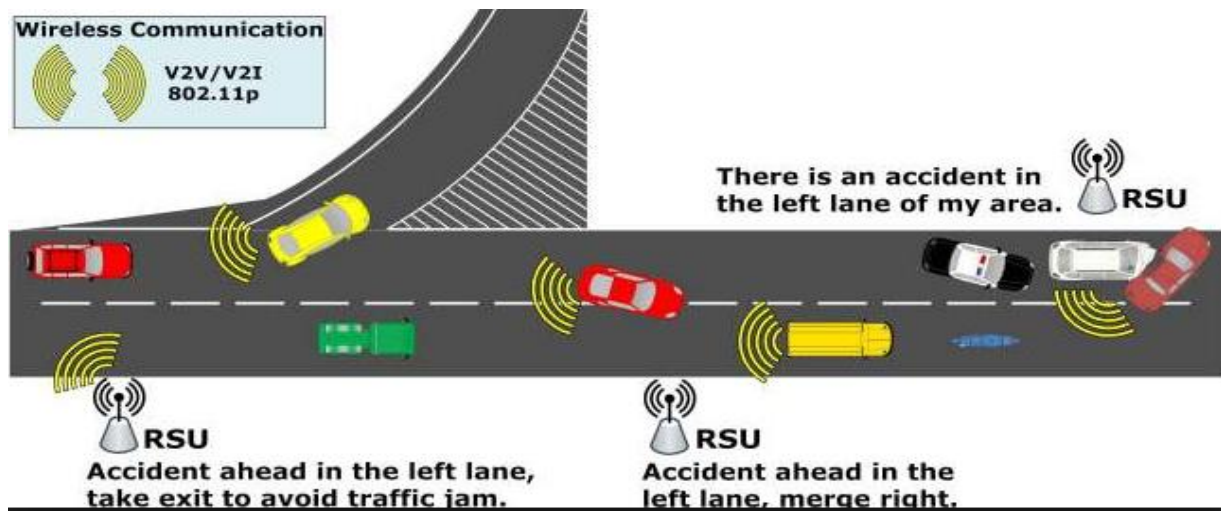
Fig. 1VANET City Scenario[http://www.iamatechie.com/wp-content/uploads/2013/06/Vehicular-Ad-Hoc-Networks-and-manet.png]

RELATED WORK

The performance assessment for two existing routing protocols for our specific application using our proposed simulation result shows that AOMDV outperforms AODV due its capacity to search for alternate paths when a current link breaks down. It provides better figures for number of packets loss and packet delivery fraction (PDF). In addition, AODV provide better average delay as compared to AOMDV. But they give almost the same results in terms of rate distortion [1]. The observation is carried out on parameters or metrics like Packet Delivery Ratio (PDR), Average Delay and Throughput. The experiential results of simulation prove that by multiplying the sum of several nodes, the performance of network is strengthening in both the AOMDV and AODV while in a network with a limited count of nodes the Direct Source Routing(DSR) shows improved performance of AOMDV as compared to AODV. Also AOMDV shows better throughput as compared to other two protocols. Selecting the finest protocol entirely is relevant to the adjacent range of available network of few kilometres and various circumstances like the motility of the nodes [2]. The method called Load Balancing Based Selective Ad hoc On-Demand Multipath Distance Victor (LBSAOMDV) is a result of advanced AOMDV routing arrangement for a specific rescue application. The uniqueness and significance of the LBS-AOMDV protocol to provide the data for the accessible bandwidth for every single route within its range. Moreover, it minimizes the traffic by reducing the density of hop receiving the RREQ requests. Also it is advantageous for the RREQ operator to select the desired node, which receives the next incoming packets. The approach is to make LBS-AOMDV as a selective AOMDV as it bypasses the unwanted load. The simulation under test carried out shows that LBS-AOMDV notably minimizes the count of RREQ compared with AOMDV. Further, unlike AOMDV, only appropriate routes are occupied to form the dedicated and reliable path to destination. On other hand, the opted routes by LBS-AOMDV are ready to match the specific requirement of the Quality of Service (QoS) in the proposed design network. Multiple path routing scheme distribute the traffic load among various nearest available route to reduce overcrowding in terms of different alternative paths by their proposed work. Further it accommodates and gives number of benefit like reduced E2Edelay and congestion, increased bandwidth and improved safety provision in case of any emergency. The demanding function of routing in composite network is to give desired Quality of Service (QoS). The important aspect of multiple path routing has to determine disjoint routes from the originating source to the final destination and also to make accessible assets to fit the QoS demands of the specific specialized services [4-5]. The problem of identification of dislocated paths from a source node to destination node in wireless VANET networks is equivalent to the flow allotment problem in a mobile network. In addition, locating the n number of disjoint paths in a proposed network is similar to finding a movement allotment of value n in a concerned individual-capacity of highly mobile network [6].

Thus vehicular communication and their connectivity with Road Side Units (RSUs) are major and interesting issues in VANETs especially when network is highly mobile. The AOMDV protocol is modified to resolve a connection issue due to rapidly moving and changing network topology. It provides alternate multiple route for successful distribution of information from the source node to the destination node. This route recovery scheme helps in maintaining and connecting of large number of packets than AODV routing. Anyhow maximizing the speed of every vehicle will reduce the entire performance of the network. The probabilistic relay which has been introduced by adjacent vehicle provides information regarding lost data packets in dedicated communication. This relay has been taken care by 802.11p IEEE standard as a MAC standard and as a combination of AODV with possible relay (AODV-PR) and AOMDV with possible relay (AOMDV-PR) [7]. In [8] routing protocols like DSR, DSDV, AODV, AOMDV are evaluated by correlating the various performance merits such as Packet Delivery Ratio (PDR), Packet Loss ratio

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(PLR), and Average E2E delay with different interval time and figure of node by considering TCP and CBR connection by using NS2.35 network simulator for active wireless ad hoc network. The network security and intelligent transportation system (ITS) are important aspects of any Vehicular Ad hoc Network (VANET) applications, which need proper Vehicle to Vehicle (V2V) and Vehicle to surrounding Infrastructure (V2I) communication connectivity; significantly we can say routing terminology. While proposing the design methodology for specific network and routing protocol in VANET, driver's information of vehicles within the network can be utilized as routing metrics, which can further provide additional routing detail and significant information. A routing metric in which hop count and speed is proposed with vehicle driver's information and delay reduction on every consecutive arrival. It helps in broadcasting emergency messages within the network. As wireless sensor network requires quality and broad research to be carried out to provide run time communication with improved and advanced Quality of Service (QoS) for emergency applications. Ad hoc On Demand Multipath Distance Vector (AOMDV) protocol is implemented basically for extremely changing topology and mobile networks whenever dedicated link fails and route failure occur regularly. For effective communication in multiple path network AOMDV provide provision of selecting more than one path. The partially disjoint path maintain stability and select more than one path that are stable from the previous history of these multiple paths maintain by every active node in a network [9-11]. The experimental simulation set up for city scenario is implemented by using NS-2 platform with their varying speed and number of actively participating adjacent vehicles. The simulated results prove that AODV and AOMDV routing protocol gives improved Packet Delivery Ratio while DSR has lower Average End-to-End delay(E2E) [12].

METHODOLOGY AND IMPLEMENTATION

In our proposed work we have considered the city scenario. In these twenty mobile nodes have been distributed which are highly mobile. This network is designed by considering the city traffic pattern. Mobile nodes can communicate with its adjacent node within their communication area or outside of the either by intermediate nodes or by RSU unit available. Each node in a network is having its own mobility with Omni-Directional antenna installed on it and radiates constant power in all possible direction. In this set up we use adjacent node and number of active connections in a network. The Wi-Fi connectivity is provided through IEEE 802.11, vehicular communication standard into the network. For the above said network two routing protocols were utilized one after the other and performance merits PDR, PLR, Average E2E delay and throughput were trace down. In order to measure the performance metric for each routing protocol are calculated from trace file and their average value are summed up for plotting comparative graph.

The network simulator for above scenario is built using NS2.34 under Linux platform.NS2 is open source simulation tool provide educational support in networking research. It is a combination of object oriented tool command language (OTCL) and object oriented C++.For the implementation we consider 20 nodes in rectangular area of 1000m *1000m.Simulation time is 500 seconds. The mobility speed of each node is 10m/s. The network simulator parameters were discussed in table -1.

Table -1 Simulation Parameters

Parameters	Simulation Value
Simulator	NS – 2.34
Speed	10 m/s
Simulation Period	500 sec.
Antenna Type	Omni - Directional
Radio Propagation Model	Two Ray Propagation
MAC Type	802.11p
Routing Protocols	AOMDV,AODV
Simulation Range	1000 * 1000 m
Mobile Nodes	20

ROUTING PROTOCOL AND PERFORMANCE MERITS

Ad hoc on Demand Distance Vector (AODV)

The AODV protocol is unipath routing and improved version of DSDV routing protocol. It maintains route discovery only when it is in demand or required to establish path. It maintains entry for each mobile node and its next hop count routing information in its look up table, which contains the dedicated path to its present destination node. In this manner it keeps updating adjacent node whenever there is active link between sources to destination node. It does not waste energy after each node in network. In addition, AODV keep a track of destination sequence number used by DSDV protocol. It comprises of two different types of mechanisms: route recovery, updating and route maintenance. The first technique is very helpful in route discovery to discover route from source to destination mobile node and second helps in maintaining route when there is route failure. The benefit of this technique are that less memory space is utilized as data of only active routes are track and maintained in updated routing table. This in

turn improves overall performance of the network under design. Whereas, the disadvantages are that in larger network it doesn't support better performance and results into various asymmetric links.

Ad hoc On-demand Multipath Distance Vector (AOMDV)
AOMDV is multiple paths routing protocol as its name suggest. The AOMDVs protocol is extension or improved version of AODV(Unipath) routing protocol. The important benefit of this proposed algorithm is to provide many reliable different paths from desired source to final destination when there is link failure. It offers multiple stable, dedicated, reliable and disjoint paths technique. Once the multiple routes are discovered by AOMDV stores the information about every path in routing table. The major task of AOMDV protocol is route discovery. The alternate path is chosen on the evidence of number of hop count in its multiple route recoveries. The path selection is done on less number of hop counts and its reliability to flood request from source to destination. It keeps updating the routing table information for multiple path after each route discovery. AOMDV further compute them on the basis of two parts: First to evaluate and maintain numerous free paths at every node of the network and figure out link-dislocate paths to measure its performance. However, the performance of AOMDV is relatively more improved than AODV. The Quality of Service (QoS) is identified and evaluated by their performance parameter in terms of merits that are of more importance to the network under design. This performance metrics were discussed below in detail to offer its comparative analysis for AODV and AOMDV.

Packet Delivery Ratio(PLR)
Packet delivery ratio (PLR) is determined by the number of packets delivered successfully to the destination node to the number of data packets sent by the source node over a time stamp of the simulation period. It is given by following ratio:

PDR = (Number of Received Packets) *100/ (Number of Sent Packets)

Packet Loss Ratio(PLR)
Packet loss ratio is the number of packets being lost over period of simulation from source to destination. Packet loss is determined by a percentage of packets lost with respect to packets sent.

Loss Packet Ratio= (Sent Packets-Received Packets) / (Sent Packets) * 100

Average End-to-End Delay(E2E)
End to End delay is used to calculate time taken by packet (in average packets) to travel from the source node to the destination node. It is nothing but to differentiate the time at which the packet is being generated and a packet is being received for a specific simulation period give the average end-to-end delay for the received packets.

Average End to End Delay = (time at which packet received – time at which packet sent)/total no. of packet received

Average Throughput
Throughput is the number of packets received successfully in a specified simulation time and it is represented in bits per second.

Average throughput=No. of Bytes Received / Simulation Time Kbps

SIMULATION RESULTS AND COMPARATIVE ANALYSIS

In this network simulator 2.34 tool is used to analyse the simulation results for the network. The simulation results help further to calculate the performance metrics like PDR, PLR, Throughput and E2E against the number of mobile nodes which has been distributed in a network. The number of mobile nodes is 20 with varying speed in a fixed network of 1000*1000 areas. The traffic type is CBR (Constant Bit Rate) with a size of 1000 bytes User Datagram Packets (UDP) over simulation time of 500 seconds. To compare and evaluate the performance we have utilized two routing protocol AODV and AOMDV. As compare to single path (AODV) the multiple paths (AOMDV) could significantly decreases the traffic delay. The AOMDV always search the alternate path due to which traffic load is distributed for different routes from source to destination. The utilization of AOMDV proves the reduction in request congestion on an adjacent single node. Hence it is more efficient than AODV.As a result of this it gives minimum delay with reliable connectivity. The simulation runtime scenario is shown in Fig.2.

In our simulation we compare the AODV and AOMDV in terms of its performance merits. For simulation we consider the vehicles are moving in opposite two-way direction with varying speed. The communication is established between them using both AODV and AOMDV routing protocols. The ultimate outcome will be analyzed from the execution of tcl code for this network. As an outcome of a tcl code two different types of files were obtained with the extension of network animator (nam) file and trace file (tr). Further to evaluate the exact results from the trace files we used 'awk' command for different parameters like Packet Delivery Ratio, Throughput and End to End Delay.
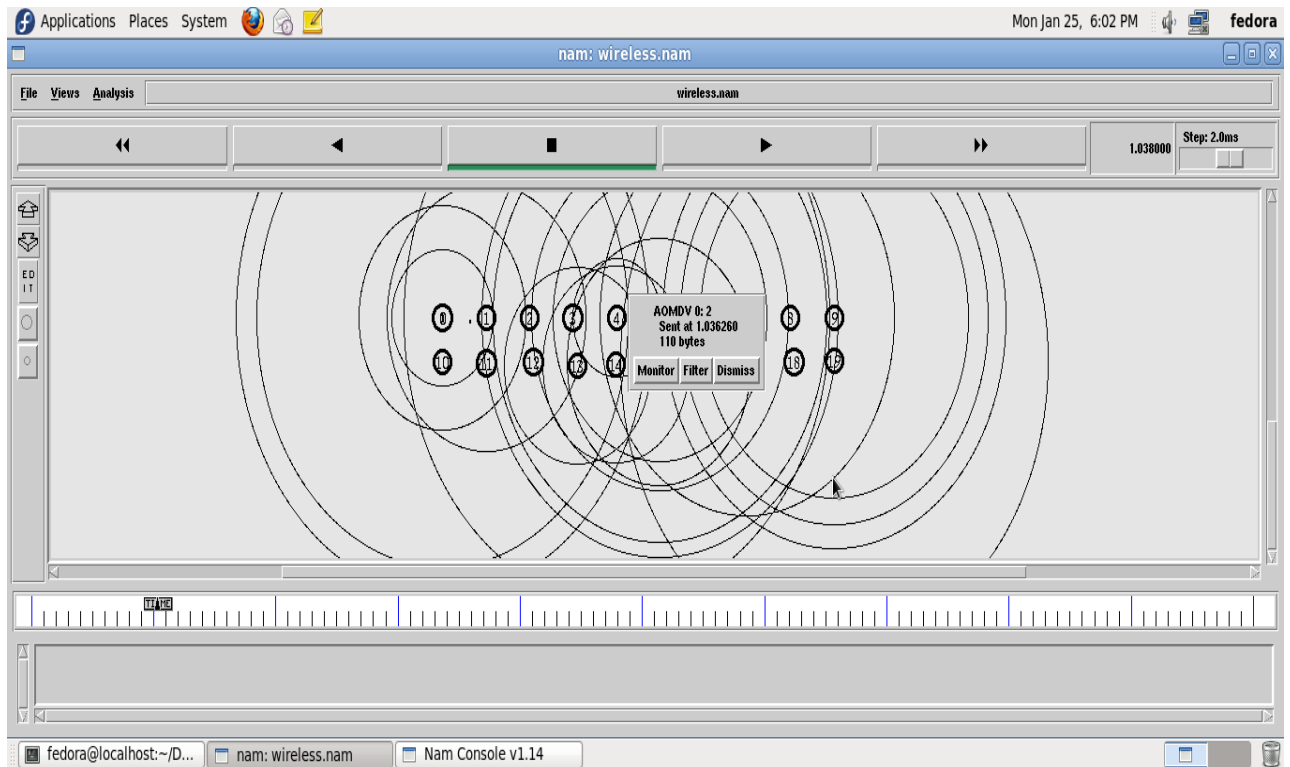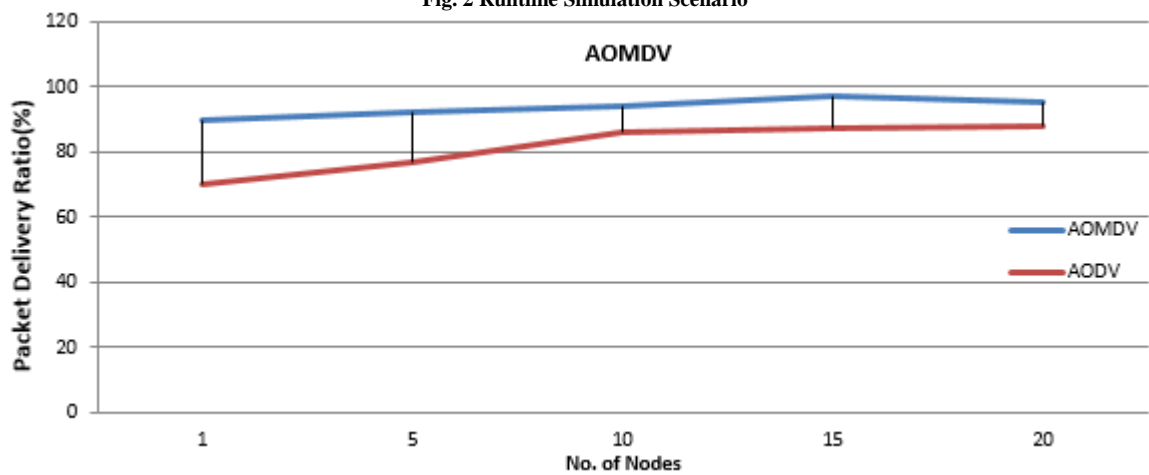
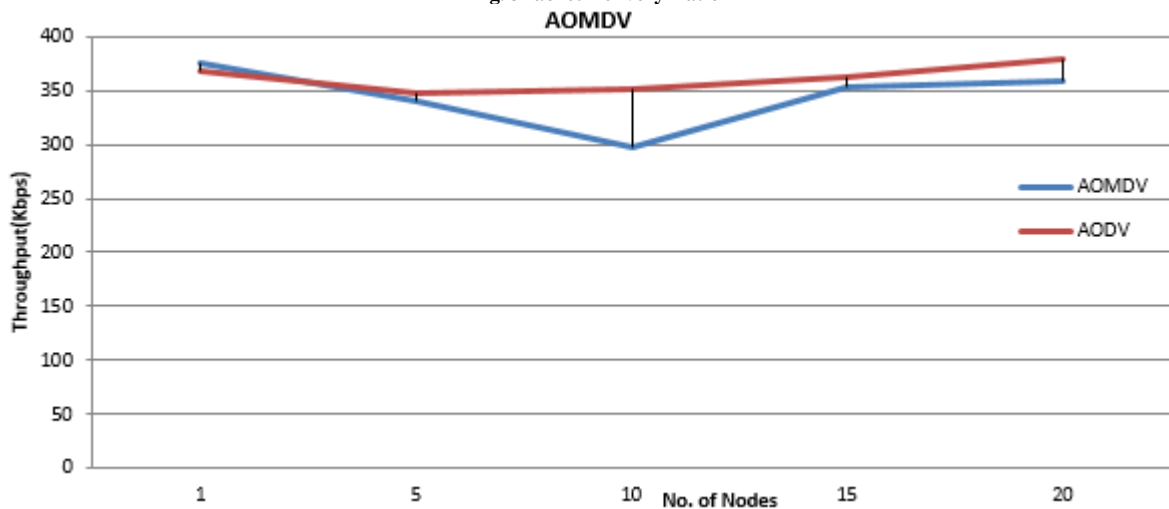**Fig. 2 Runtime Simulation Scenario**

Fig. 3Packet Delivery Ratio

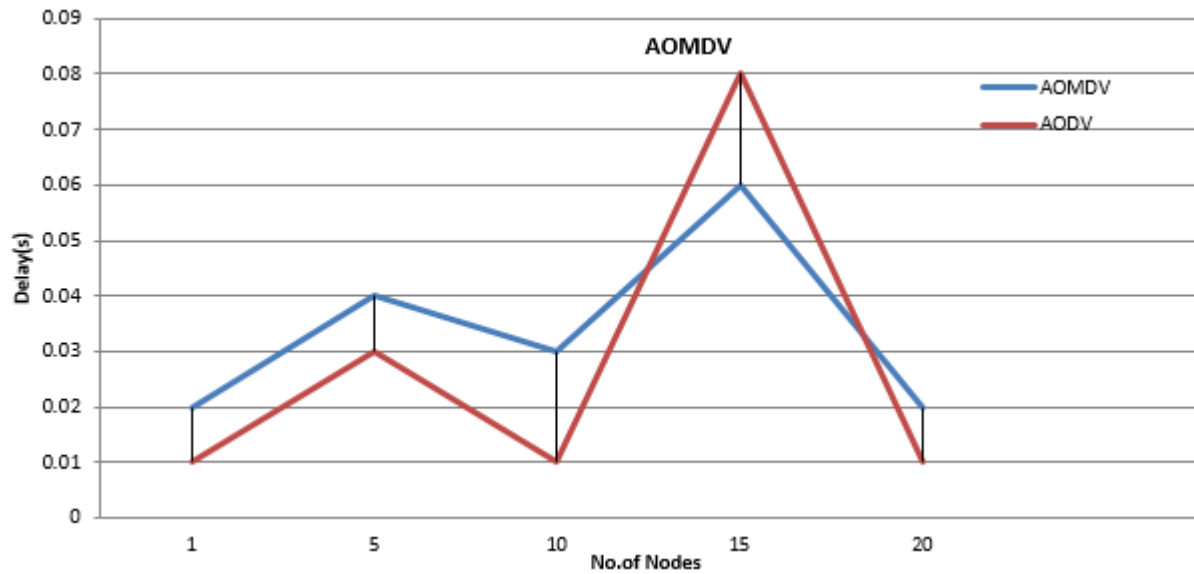**Fig. 4Throughput Vs No. of Nodes**

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Fig.5 End to End Delay

Fig. 3 represents simulation result for packet delivery ratio (PDR). Based on obtained result AOMDV routing proto-col gives improve PDR in our chosen network condition. In AOMDV the packet delivery ratio is obtained against packet loss ratio. For emergency services the delivery of broadcast message from source to destination is achieved through multi hop network. The PDR we are able to achieve is more than 95%.as compared to AODV. So from the output graph we can comment the AOMDV more suitable for emergency services since it provides alternate path for every successful delivery.

In Fig. 4 throughput vs. Number of nodes is illustrated. According to result AOMDV routing represent better throughput whereas AODV routing show poor throughput as compare to AOMDV routing protocol. The experien-tial outcome or final result shows, the network performance is improved by increasing the number of nodes in AOMDV as compared to AODV.As the number of nodes in a network increases the throughput increases. In our simulated result it is seen. The average obtained throughput is 392 Kbps.

In Fig. 5 the comparison of E2E delay is shown with respect to both the routing protocol. Here also AOMDV is bet-ter as compared to AODV. The simulation output determined that our modified proposed newly design network of emergency services significantly improves the performance of network by all the possible movement of nodes itself and they are more appropriate than the well-known AODV protocol for the emergency services in VANET consid-ering city scenario.

CONCLUSION

In this paper we are much more concerned and aware about the emergency services which have been developed by the city Scenario. Emergency services here we have represented is one of the basic, fundamental and most important services provided by wireless communication networks. The entire paper focuses on the comparison and perfor-mance analysis of two existing routing protocol for various services offered by them in case of any emergency. Based on the network city scenario and its different parameters of routing protocol, we are able to give comparative analysis of design network. By this observation and obtained simulation result, it is possible to highlight that our design methodology significantly achieves better network performance and able to provide the better requirements for emergency services in VANET. For the result has proved the multipath AOMDV routing protocol gives better results in our scenario. For the future work to be carried out, we can consider large number of mobile nodes and implement more efficient networking schemes for various rescue application in urban regions.

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