International Journal of Future Generation Communication and Networking
Vol. 13, No. 3, (2020), pp. 877 – 886

# Multipath Routing Protocol for Emergency Services in VANET

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***Abstract***

*In present scenario the population and vehicles are increasing rapidly in every part of world especially in urban areas. In this areas life is at greater risk. The recent research and survey has already proved the accident took place for every second in every part of the world, thus the life of individual at higher risk. Since VANETs have great potential in improving the traffic condition and various routing protocol has been developed in this direction. The recent advancement in wireless technologies and automobile industries together initiated important research interest in the area of VANET. The two major communication systems supported by VANETs are first is Vehicle to Vehicle (V2V) and another is supported by infrastructure like vehicle to infrastructure (V2I).This two types of system is supported by wireless access such as IEEE 802.11p standard technologies. This revolutionary innovation in wireless technology has proved to improve the safety application on road, traffic congestion and route guidance through the development of Intelligent Transportation System (ITS).As a result the government agencies, automobile sector and researcher are all together contributing to enhance the feasibility of ongoing projects in VANETs. The newer applications in this regards like alarming accident prone area, vehicle collision warning and traffic information broadcasting has made the VANETs system more popular in the field of wireless communication. In our design approach we have utilized the* Ad hoc On-demand Multipath Distance Vector (AOMDV) *Multipath Routing Protocol over Adhoc on demand Distance Vector(AODV),which is a Single Path Routing Protocol. Further we have obtained two distinguish Multipath Routing Protocol of its own type Priority (PAOMDV) and Modified (POAOMDV) to evaluate our results in emergency services.*

***Keywords:*** *VANET,Emergency Services,AOMDV,PAOMDV,MAOMDV*

## 1. Introduction

In our proposed scheme we have worked on current research states, real time rescue application in case of emergency, newer challenges and potentials of VANETs to improve the existing system. The proposed scheme, design to provide real time road side assistance for the vehicle in case of any emergency. This system overcome the existing methodology and enhances the broadcast reliability using multipath routing methodology. In our scheme if the dedicated path in the network fails it switchover the alternate reliable path without any delay. Our proposed routing based system has the combination of both OBUs and RSUs of the VANETs to broadcast danger or emergency situations with V2V and RSUs message exchange. The selected routing

ISSN: 2233-7857 IJFGCN

protocol for this proposed application is AOMDV (Multipath) which is supported by dynamic path selection over an IEEE 802.11p standard. The performance of the application can be evaluated through many simulations parameters of AOMDV protocol executed in different city map. This proposed scheme is quick in response and increases the efficiency of the network in case of any real time emergency occurs within a design network.

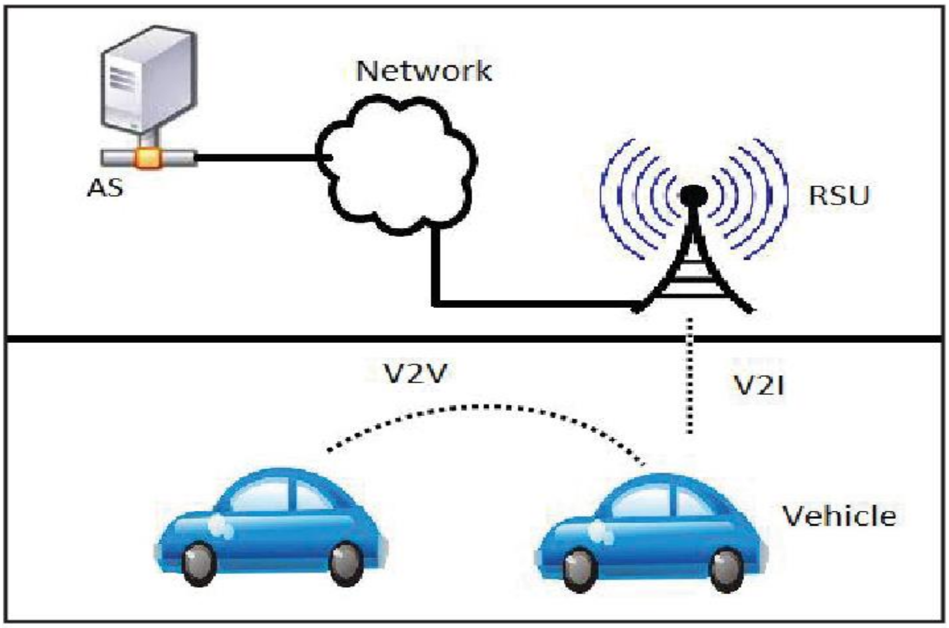


**Figure 1.VANET Architecture**

Vehicular Adhoc Networks are inherited from the principle of Mobile Adhoc Network (MANETs) –which forms a network which is wireless to exchange data to the OBUs of vehicles. VANETs were first introduced in 2001 for Vehicle to Vehicle (V2V) communication and forming network applications for the sake of exchanging information among them. Further it was extended to road side assistance for vehicle and it is collaborated with the adjacent available infrastructure. This type of VANETs are name as vehicle to infrastructure communication(V2I).The type of development in V2V and V2I communication is to provide navigation, safety applications and other road side assistance. Further VANETs system is becoming popular and a key part for Intelligent Transportation System (ITS) applications. Hence VANETs are attracting many researchers from both the field of academia and automobile industries. VANETs system is capable of handling the continuously changing topology and high speed mobile nodes for the design network. For example we consider one of the metropolitan (Delhi) areas which have heavy traffic daily at prime time, in such areas any emergency services like ambulance, fire brigade, police, and minister vehicle etc. need to be cleared from source to desired destination. In such situation VANETs enable vehicles to communicate to every adjacent vehicle within its network range and with Road Side Units (RSUs) to resolve and improved the problem of emergency services. Communication between vehicles contributes to the reduction of traffic jam and car collision with predictive knowledge about current road information.

## 2. Methodology

As per our methodology the new system will work on two broader aspects in VANETs: first one is reliable network design and second is safety application. The network design will be provide the range of area under considerations, its coverage, adjacent infrastructure assistance and collection of data timely from the deployed nodes (vehicles) within network. Whereas safety application is used to inform about the changing traffic conditions to the drivers for the deployed network. It includes information about speed, traffic congestion, lane changing, overtaking, collision, emergency vehicle warning and pre accident warning. This kind of safety applications of VANETs alert about the network scenario and traffic conditions and enable them to take necessary corresponding action. The implementation of our proposed network is shown in figure 2.where it shows the randomly deployed network within the specified area of 1000*1000 meters. It shows the different path or routes chosen by our active nodes from source to destination.

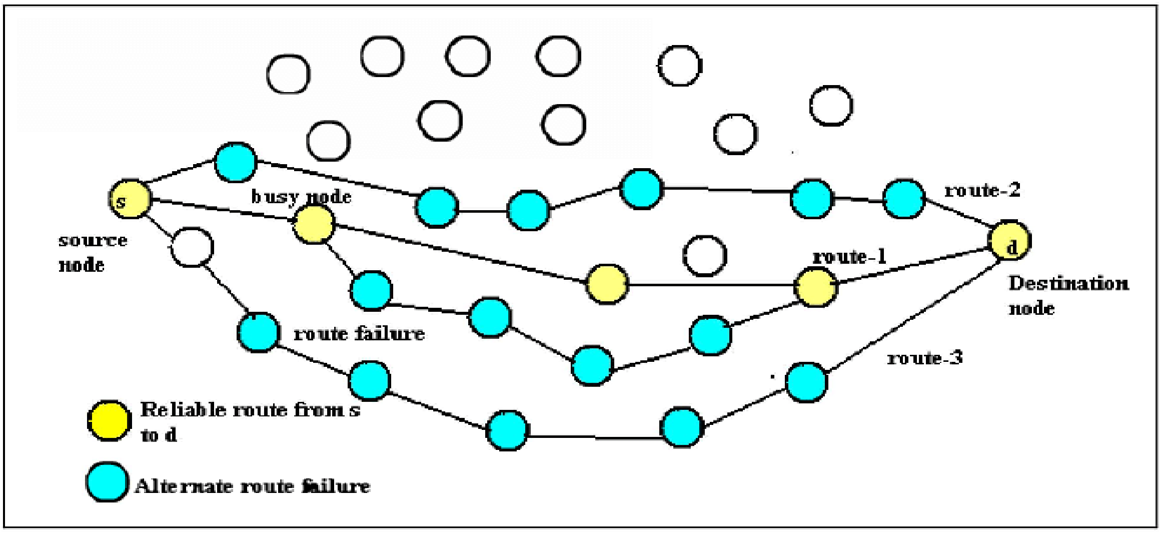


**Figure 2.Illustration of Proposed Network with Multipath Routing**

## Emergency Services

The traffic scenarios in urban areas are becoming worst day by day. We are witnessing the worst situation every day due to heavy traffic in early peak hours. In such condition if any accident took place and it’s very difficult to reach at accident prone area in stipulated time. The VANET system helps in making the emergency services available on time without any delay.

## Route and Topology Guidance

For every vehicle in the network VANET gives information regarding its exact location, speed and its route map from source to destination. This is possible due assistance from its neighbouring vehicle and Road Side Unit (RSU).

## Road side services

The VANET also helps in gathering information like road side stores on the run like petrol pump, medicine store, sanitary needs, hospitals etc. This all information is collectively store in central server and further distributed with RSU. This information is further distributed to each vehicle in the network.

Network Routing is the process of moving data packets from source to destination without any delay. This process of message dissemination is carried out by desired dedicated path assigned to the networks known as routers. As we know VANETS are emerging technology and it has proved its consistency in reliable exchange of information over a stipulated network. VANETS are also fully implemented on routing process for exchanging information over a design network. Due to random change in topology, network partitioning and unstable connectivity information routing is challenging and difficult in VANETs. Routing in VANETs is current area of research among many academician and industry. In highly mobile network where speed and time both are at priority and routing need to be the very efficient and reliable source of communication

## 3. Simulation

In this simulation 50 nodes are defined with five nodes having traffic signals. Then the edges resembling the road lanes were initialized between the nodes. The node file and edge file are together used to get a map net. The route file, which defines the vehicle itself, various routes and flow over the routes, is combined with the net file to get the SUMO configuration file. This configuration file is run over SUMO for visualization of road traffic. This visualization is done using SUMO-GUI.

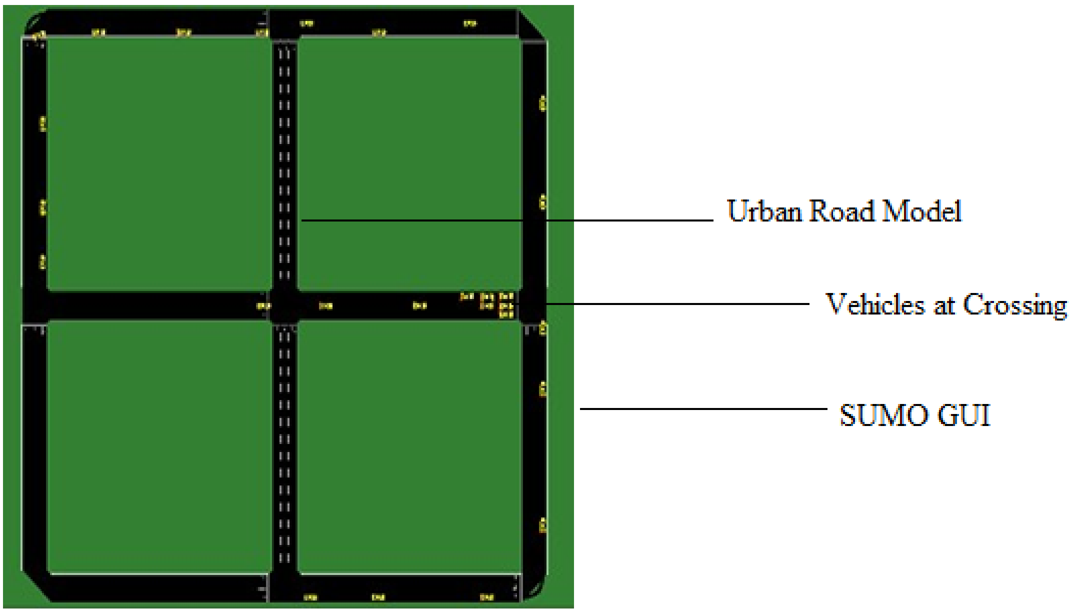


**Figure 3. Visualization of road traffic in SUMO**

Traffic simulation is the most efficient way to provide ways for efficient and intelligent transport system. SUMO is the open source micro traffic simulator which can provide the mobility scheme for simulation of VANET over NS2. Version 0.12.3 of SUMO is used as MOVE is supported only in SUMO 0.12.3. The sumo configuration file is required for visualization of traffic in SUMO. This configuration file is generated with MOVE which requires node file, edge file, net file and the route file. This set up obtained on SUMO is shown in Figure 3.

On this design network priority is assign to the emergency vehicle and accordingly information is disseminated in the entire network. Later the Modified AOMDV (MAOMDV) and Priority AOMDV (PAOMDV) routing protocol is applied to above said network with different density of nodes. The simulation parameters and its value for the network has been shown in the Table.No.I.

**Table 1. PARAMETERS Used FOR TRAFFIC SIMULATION**

| Parameters | Value Used |
|---|---|
| 1.Simulator | NS.2.34 |
| 2.Simulation Time | 1100 sec |
| 3.Channel | Wireless |
| 4. Radio Propagation | Two Ray Ground |
| 5. Antenna Type | Omni Antenna |
| 6. Link Layer Type | LL |
| 7. Network Interface Type | Wireless |
| 8. MAC type 802.11 | 802.11 |
| 9.Routing Protocol | AOMDV |
| 10. Traffic Type UDP / CBR | UDP / CBR |
| 11. Number of nodes | 50 |
| 12.Packet Size | 500 |
| 13. Interval | 0.2 |

## 4. Result Discussion

In our design network, the simulation and its analysis is obtained in NS-2. A node topology is created consisting of 50 nodes. All nodes are movable; of which nodes 0, 1, 2 and 5 are specific nodes with traffic lights diversion and detection. Intermediate nodes are in connection with the Road Side Units (RSUs). Whereas the node 50 is assign with the flag of destination node. The nodes from 28 to 32 are the randomly moving vehicle nodes within the specified area. Here the node 17 is the prioritized emergency assign vehicle which broadcast the priority message to its adjacent node. The dissemination of message transmission takes place by two ways of flooding broadcasting and routing with a constant bit rate data traffic connection with other nodes.

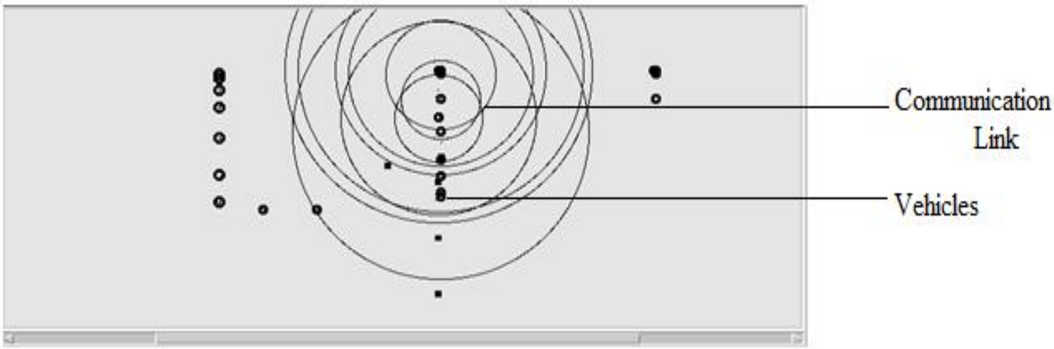


**Figure 4. Simulation Scenario**

## Packet Delivery Ratio

We note that P- AOMDV has a better packet Delivery Ratio (PDR) value when compared to M-AOMDV for each set of connections from 1 to 50 nodes. This is because in the time waited at a node, P- AOMDV can find an alternate route if the current link has broken because it is at highest priority. For example we note, that for M- AOMDV,, the performance degrades at increasing of nodes while P-AOMDV , waits till clears all node. The PDR is shown in figure 4.7.

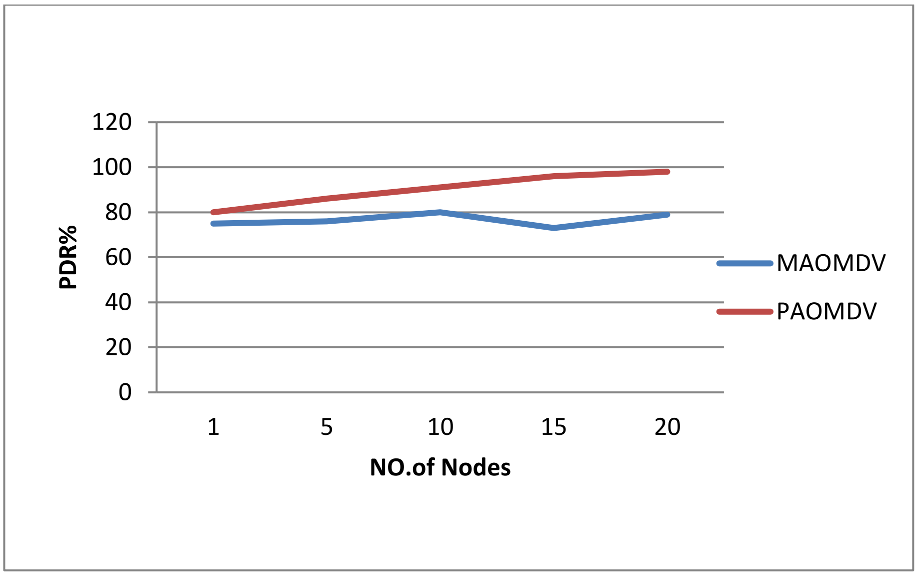


**Figure 5. Packet Delivery Ratio**

## End to End Delay for M-AOMDV/P-AOMDV

P-AOMDV has an average delay of 0.4ms, whereas the M-AOMDV average delays of 0.8ms. We note that P-AOMDV has a better average delay than M-AOMDV due to the fact if a link break occurs in the current topology, P-AOMDV would try to find an alternate path from among the backup routes between the source and the destination node pairs resulting in additional delay to the packet delivery time. It is clearly observed from figure 6.

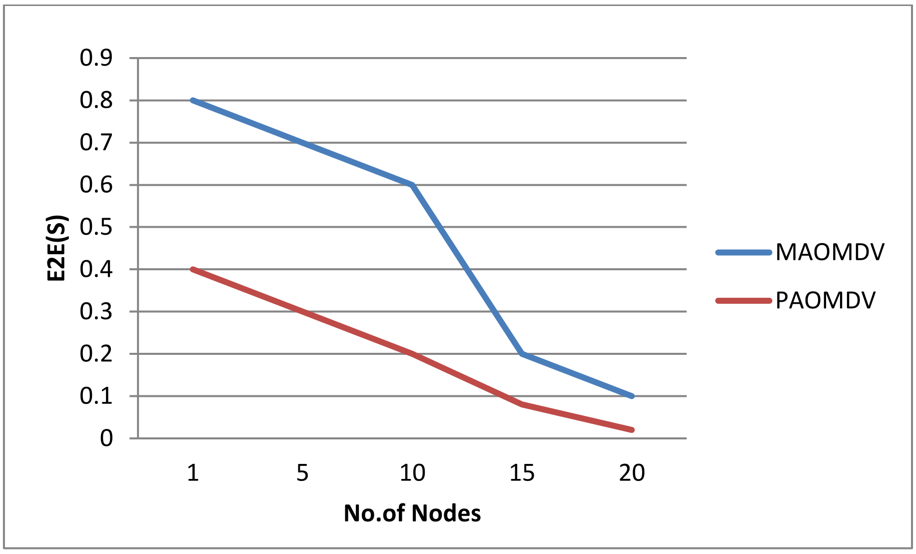


**Figure 6. End to End Delay**

## Energy Consumption M-AOMDV/P-AOMDV

Figure 7 shows the energy consumption of the proposed network. Energy is very important factor in the network which is used to keep the node activated all the time. Until and unless node is activated the entire communication takes place. Here PAOMDV saves lot of energy as compared to MAOMDV protocol.

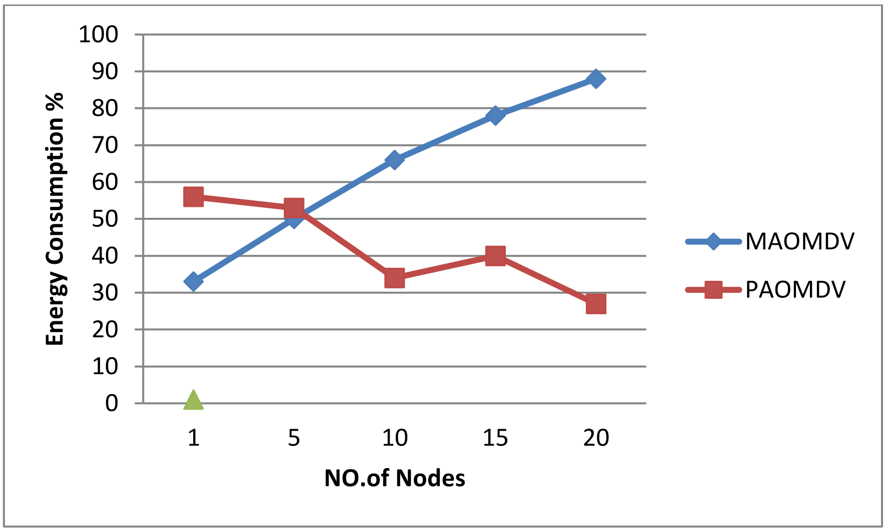


**Figure 7. Energy Consumption**

**Table 2.Comparative Analysis of M-AOMDV & P-AOMDV**

| Sr .No. | Parameters | M-AOMDV | P-AOMDV |
|---|---|---|---|
| 1 | Packet Delivery Ratio | 80.12% | 98.99% |
| 2 | End 2 End Delay | 0.8 s | 0.4 s |
| 3 | Throughput | 410 kbps | 450kbps |
| 4 | Energy Consumption | 88.76% | 27.64% |
| 5 | Routing Overhead | 850 pkts | 410 pkts |

On the analysis of performance parameters MAOMDV and PAOMDV we identified the performance of both the routing are closely resemble to each other in some parameters. The final outcome shows the PAOMDV performs better than the MAOMDV. Simulation results show that the proposed approach shows improvement in terms of end-to-end delay and PDR at varying vehicle speeds and cluster sizes. The Table 2 shows the detailed comparative performance analysis of both the modified routing protocol.

## 5. Conclusion & Future Scope

In above obtained result we have considered the possible network analysis based on possible parameters. Here we have analysed AOMDV with their possible modified version of PAOMDV and MOAOMDV. The simulation was carried out to compare these in NS 2.34 simulator by varying the speed of vehicles on the designated road and changing topology. Simulation results shows that Packet delivery ratio (PDR) and End to end delay (E2E) is better in MAOMDV but it has more Packet loss ratio (PLR) and lesser Throughput comparatively. Whereas PAOMDV and MAOMDV having better Energy consumption. So based on the significance of parameters in particular scenario, the specific modified routing protocol could be used. In future, the performance of these protocols can be evaluated when the density of vehicular traffic changes. Other performance metrics such as jitter, delivery cost etc. can be considered for detailed analysis of these routing protocols. The delivery of emergency messages can be further improved by using many more RSU's as intermediate nodes. This will also be an efficient method for sparse and dense networks along with specific application routing.

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