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# Position Based Forwarding Routing in Real Time City VANET

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***Abstract*: - VANET (vehicular ad hoc network) is an open standard for inter vehicular communication in a road or with road side station with the vehicles. Therefore routing in VANET is used to provide safety services. However these protocols face several issues mainly flooding of packets network overhead and path loss that prevent network from guaranteeing their required high packet delivery ratio and low delay. The proposed paper tackle these issues using position based forwarding routing protocol. In this proposed system a node joins a multicast group. The group periodically broadcasts its location and direction obtained through GPS system based on the application data rate fixed, any of the group member based on scheduling generates application packet containing node IDs and position of the group. Proposed protocol can be used to carry out realistic communication between VANET nodes. The system can be used for location based Spatial query systems. It can also be used as an event notification system for VANET where events may range from traffic congestion, traffic light state change at junctions, accidents and so on. The protocol reduces significant network traffic overhead of unicast system where each node attempts to transmit data to every other node. With increase in number of vehicles route cache size explodes exponentially. Proposed system helps in reducing such overhead by limiting number of packet transmission by adopting multicasting rather than unicast transmission . Simulation results in city settings show that position based forwarding protocol perform best in terms of average packet delivery rate, with up to a 40% increase compared with some existing protocols. In terms of average delay, protocol performs best, with as much as 70% decrease compared with the other protocols.**

***Key words* – position based routing, packet forwarding with position information and multicast broadcasting.**

## I.INTRODUCTION

A Vehicular Ad-Hoc Network or VANET is a technology that uses moving vehicles as nodes in a network to create a mobile network. VANET turns every participating vehicle into a wireless router or node, allowing vehicles approximately 100 to 300 meters of each other to connect and, in turn, create a network with a wide range. As vehicles fall out of the signal range and drop out of the network, other vehicles can join in, connecting vehicles to one another so that a mobile Internet is created. VANET is a subgroup of MANET where the nodes refer to vehicles. Since the movements of vehicles are restricted by roads, traffic regulations we can deploy fixed infrastructure at critical locations.

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The primary goal of VANET is to provide road safety measures where information about vehicle's current speed, location coordinates are passed with or without the deployment of Infrastructure. Apart from safety measures, VANET also provides value added services like email, audio/video sharing etc. The VANET has two types 1) V2V (Vehicle to Vehicle) 2) V2I (Vehicle to Infrastructure) communication. Basically automobile industries are uses V2V communication than V2I. Vehicle to Vehicle communication approach is most suited for short range vehicular networks. It is fast and reliable and provides real time safety It does not need any roadside infrastructure.V2V does not have the problem of vehicle shadowing in which a smaller vehicle is shadowed by a larger vehicle preventing it to communicate with the Roadside infrastructure In V2V the connectivity between the vehicles may not be there all the time since the vehicles are moving at different velocities due to which there might be quick network topology changes. The anonymity problem: The addresses of vehicles on highways are unknown to each other. Periodic broadcasts from each vehicle may inform direct neighbour about its address, but the address-position map will inevitably change frequently due to relative movements among vehicles.

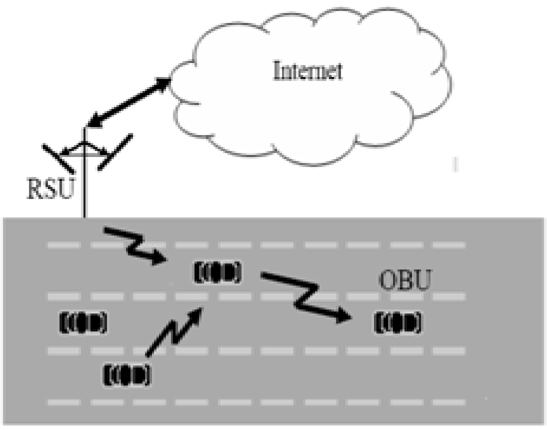


Figure 1-1 Node Types in VANETs

Different routing strategies have been defined based on prior ad hoc network architectures by targeting the specific VANET needs of scenarios and applications. These protocols can be grouped into topology based it reactive, position based, cluster based and broadcasting. Most of the VANET applications critically rely on routing protocols. Thus, an optimal routing strategy that makes better use of resources is crucial to deploy efficient VANETs that actually work in volatile networks. Finding well-suited parameter configurations of existing mobile ad hoc network (MANET) protocols is a way of improving their performance, even making the difference between a network that does work or does not, e.g., networks with high routing load suffer from congestion and cannot ensure timely and reliable delivery of messages. The major challenges associated with VANET are lack of infrastructure and shorter communication session due to rapid change in the network topology. Therefore routing protocols play a significant role in achieving successful intervehicular communication.

This paper presents a class of position-based VANET routing protocol that leverage real-time vehicular traffic information to create paths consisting of successions of road intersections that have, with high probability, network connectivity among them. Furthermore, position forwarding allows the use of any node on a road segment to transfer packets between two consecutive intersections on the path, reducing the path's sensitivity to individual node movements

In position-based routing, each node is aware of the positions of its direct neighbors by periodically sending out airframe messages that indicate the current position of the node. In addition, with the aim of sending a packet to a destination node, the sender requires information on the current geographic position of the destination node. In this paper, a position-based routing protocol in urban scenario is proposed for decreasing the communication overhead and the number of multi hops that is generated by the traffic information.

The main objective of this work is to device position based Multicast forwarding for VANET. This is a protocol where a node belonging to a group based on probability determines the next multicast hop to destination based on the position information and selects a node in a group in the direction of group where the packet is destined with highest probability of transmission to reduce path loss, network overhead and delay and to control flooding of packets.

## II.RELATED WORK

Routing has been a major research topic in MANETs. AODV DSDV DSR and OLSR are node-centric MANET protocols in which topological end-to-end paths are created. To improve on their performance in VANETs, solutions have been proposed, which exploit the knowledge of relative velocities between nodes and the constrained movements of vehicles. This information is used to select nodes with high relative velocity to the destination, predict the lifetime of routes, or reduce the number of route breaks by selecting, during the route creation, nodes that move in the same direction and with a small relative speed. Position based forwarding routing protocol, differs from these protocol where a node belonging to a group based on probability determines the next multicast hop to destination based on the position information.

Geographical routing protocols[6], e.g., GPSR[7](Greedy perimeter stateless routing for wireless networks) and GOAFR("Geometric adhoc Routing) use node positions to route data between endpoints. When a local maxima is reached (i.e., a position where progress cannot be made based on node positions), recovery strategies are proposed to route the packets around the void. Solutions propose to improve recovery strategies in VANETs by either proactively detecting potential dead-end positions or using channel overhearing capabilities of wireless networks to decrease the number of hops on the recovery paths.

The concept of anchor-based routing [9] in sensor networks has been adopted to VANET environments. GSR and SAR(spatially aware routing) integrate the road topologies in routing using those concepts. In these protocols, a source computes the shortest road-based path from its current position to the destination. Similar to RBVT, they include the list of intersections that define the path from the source to the destination in the header of each data packet that was sent by the source. However, they do not consider the real-time vehicular traffic, and consequently, they could include empty roads. To alleviate this issue,A-STAR(A mobile ad hoc routing strategy for metropolis vehicular communications) modifies GSR by giving preference to streets served by transit buses each time a new intersection will be added to the source route. CAR(connectivity aware routing) finds connected paths between source–destination pairs, considering vehicular traffic, and uses "guards" to adapt to movements of nodes. Gytar dynamically adds intersections, choosing the next road segment with the best balance of road density and road length.

MDDV [8] (A mobilitycentric data dissemination algorithm for vehicular networks), and VADD[10] (vehicle assisted data delivery) use opportunistic forwarding to transport data from the source to the destination in VANETs. VADD uses historic data traffic flow to determine the best route to the destination. MDDV considers the road traffic conditions and the number of lanes on each road segment to select the best road-based trajectory to forward data. In both protocols, when no vehicle node can be found along the forwarding trajectory, a carry-and-forward approach is used, and the data packets are stored until a more suitable relay is found. These protocols are well suited for delay-tolerant applications. A delay-tolerant epidemic routing approach for VANETs is presented in . Under very sparse vehicular traffic and at the early stages of the deployment of wireless technology in vehicles (when many vehicles will not have wireless interfaces), such opportunistic forwarding solutions will be useful to car-to-car ad hoc communications.

The RBVT(road based vehicular traffic) protocols, on the other hand, provide support for applications that are not necessarily delay tolerant. RBVT protocols require that an end-to-end path exists for data to reach the destination. Receiver-based next-hop selection is proposed at the routing layer and at the MAC layer all neighbors receive the entire packet, but only one neighbor will rebroadcast it. This neighbor is the one that wins a time-based contention phase in which the node closest to the destination is favored. Minimizing the remaining distance to the destination is also the objective which operates at the MAC layer. These methods consider the unit-disk assumption, which does not hold in real-life VANETs. RBVT next-hop self election can work in realistic conditions, where obstacles and noise frequently affect wireless communication, because it incorporates multiple criteria in the selection of the best next hop (i.e., forwarding progress, optimal transmission area, and received power).

Multicriterion receiver-based next-hop [5] selection has been described in a general form. The authors demonstrated that using carefully selected criteria can improve the election of the optimal next hop. We apply these results in the context of vehicular networks and define a set of criteria to optimize the election of the next hop. We note that real-life measurements with commercial GPS receivers showed errors in the reporting of GPS positions in urban environments. RBVT protocols follow paths made of road segments; thus, they are more resilient to vehicle node position errors of a few meters. The integration of the inertial navigation system into GPS receivers is expected to improve the detection and handling of GPS position errors.

## III. SYSTEM DESIGN

As shown in figure, firstly run the sumo server which is responsible for communicating with omnet simulation. Then connection manager manages the connection sent through sumo server about vehicle position.

The mobility manager identifies the change in direction or position of vehicles or there is congestion to enable application layer.

Application layer, node creates application packet and propagate to as many number of nodes as possible. Then application layer determines the local multicast group depending upon the position and transmits group information periodically through application sub layer.

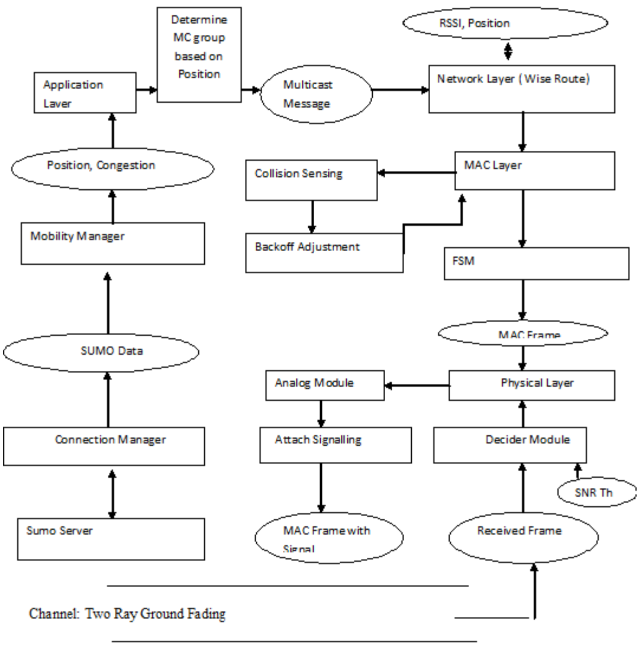


Fig 1-2. Flow diagram of packet routing

Application packets forward to network layer, through WiseRoute protocol the position of node based on signal strength and RSSI is identified.

Then we defined MAC layer to adjust backoff suitably whenever collision is sensed. Through fair scheduling mechanism, determines the transmission schedule of the message. The MAC is connected to physical layer which implements two modules they are analogue and decider module.

The analogue module is considered as input, consists of MAC frames attached with signal. The decider model checks the signal which meets SNR threshold upon receiving any frame or signals.

## IV. IMPLEMENTATION

We implemented our project using OMNeT4.2 and SUMO simulator. Simulation is configured with simulation time to record data. Simulation also implements to print debug message from different layers through run time. Activating scalar and vector recording results in recording of data for performance analysis.

TraCIManager links sumo server with OMNeT simulation. It is responsible to pass suitable configuration file to sumo server and get result of position of vehicles, routes and connection between vehicles from sumo server.

MAC and Application layer is configured which allows application types are TraCIDemo, BurstAppl, BaseAppl and MAC allows, bitrate, ContentionWindow, and maxTxAttempts is an input parameter that defines frequency of message propagation and determines network packet performance like packet delivery ratio and delay.

We define ApplicationRate as our output parameter which is number of Packets per second transmitted by application layer. It needs to define how many packets are actually sent down. Similarly handleMessage method can be declared in BaseAppl.h and defined in BaseAppl.cpp. We can put a counter to count number of packets received by application layer.

TraCIDemo is a specialized application that notifies the nodes about their own position, velocity and direction through a multicast packet transmission. Firstly it subscribes to MobilityChange event of mobility layer. Whenever there is a significant change in direction or position or velocity of the nodes, nodes create application packet and propagate to as many numbers of nodes as possible. Nodes join a local multicast group and setup application sublayer that transmits group information periodically depending upon the burst rate.

### *A. Algorithm*

Step1: Run sumo server.

Step2: Obtain the vehicle location as log file.

Step3: Each node joins a Multicast group based on Position. Each node in the group generates message about their position which is converted to Multicast packets.

Step4: These packets are forwarded using Position based routing.

Step5: Mobility is Traci mobility for vehicles and static for obstacles.

Step6: Nodes will put their **x** & **y** position into a global variable (common buffer readable by all layers).

Step7: Vehicle listens to airframe broadcasted by segment to know which the other vehicles it is directly connected to the group. Then forward packets directly to other groups which are close enough and in one hop distance.

Step8: If the destination group is not reachable, select the best next hop depending upon distance.

Step9: Else it finds the vehicle with best link quality through delay.

## V. SIMULATION SETUP

In our work we are using OMNeT++ version 4.2, on a newer versions some of the api's have changed. The Eclipse-based IDE allows implementing algorithms developed as separate models without OMNeT++ intervention, to allow execution later on the real modulated devices. OMNeT ++ cornerstone is a simple module defined in NED files; while the activity is defined within C++ classes and C functions. The OMNeT++ itself has no built in modules so some framework has to be used. The selected framework is the MiXiM frame work.

MiXiM is a simulation framework for wireless and mobile networks using the OMNeT++ simulation engine. The MiXiM framework is a merger of several OMNeT++ frameworks written to support mobile and wireless simulations.

In addition it is possible to connect SUMO Simulator**,** to this simulator in order to create a more real movement of cars. SUMO is an open source, highly portable, microscopic and continuous road traffic simulation package designed to handle large road networks.

TABLE 1 SIMULATION PARAMETERS

| | |
|---|---|
| Simulator | Omnet4.2,SUMO |
| Simulation time,<br>Number of experiments | 1000sec<br>3 |
| Distance between nodes | Erlang Distribution |
| Mac ,phy | IEEE 802.11b |
| Channel model | Two Ray Rayleigh fading |
| Average SNR | -84dB |

## VI. RESULTS

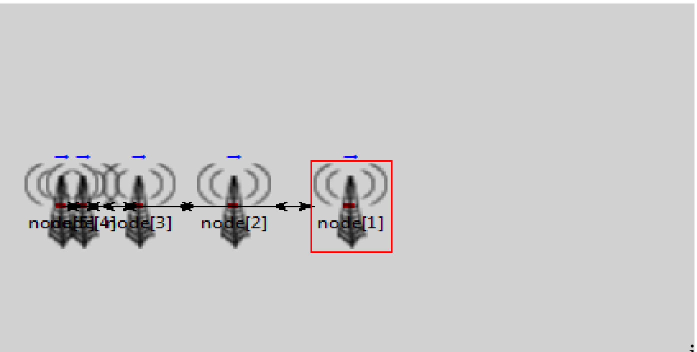


Fig 1-3 pining of cars

The above fig shows that every cars are pinging to communicate with each other in VANET.

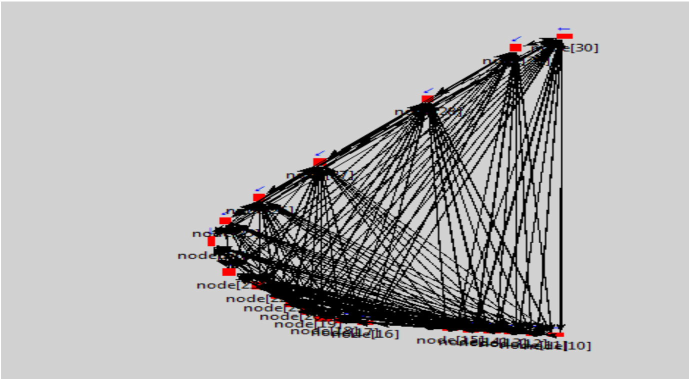

Fig1-4 multicast broadcasting of airframe

As shown in above fig 1-4 the airframes are forwarding to different vehicals with position information.

### A. *Performance metrics*

**Packet delivery ratio:** Packet delivery ratio is defined as the ratio of data packets received by the destinations to those generated by the sources.

PDR= S1÷ S2 Where, S1 is the sum of data packets received by the each destination and S2 is the sum of data packets generated by the each source.

**End to end delay:** The average time it takes a data packet to reach the destination. This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue. Mathematically, it can be defined as:

Avg. EED=S/N Where *S* is the sum of the time spent to deliver packets for each destination, and *N* is the number of packets received by the all destination nodes.

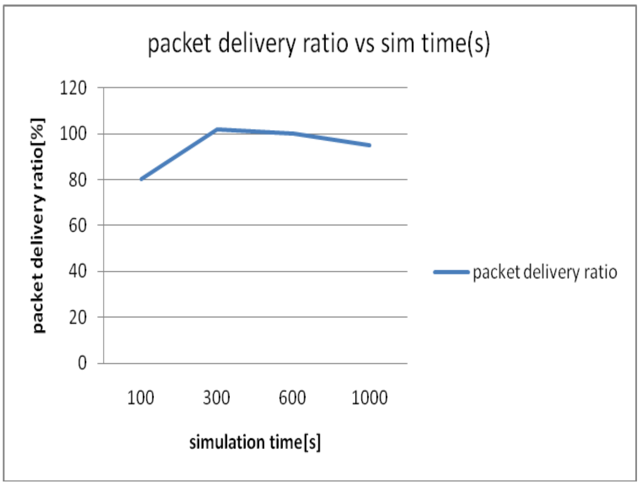


Fig 1-5 packet delivery ratio [%] vs simulation time[sec]

As the simulation time increases the packet delivery ratio in the network increases at certain optimum time and then it decreases slightly.

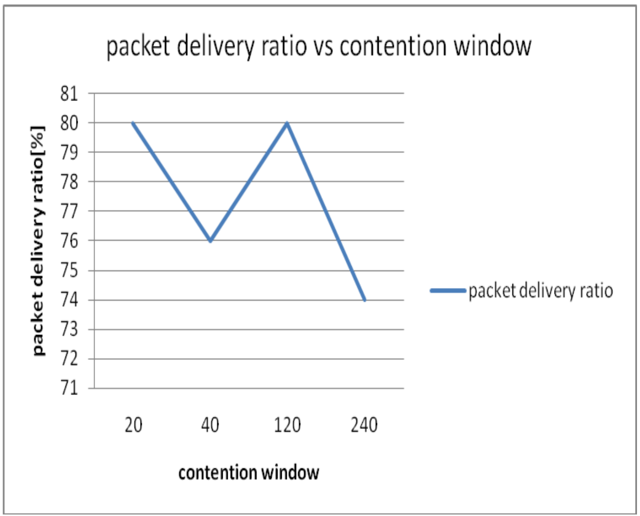


Fig1-6 packet delivery ratio [%} vs contention window

As the size of contention window increases the packet delivery ratio decreases for size 40 and 240 and it increases for 120.

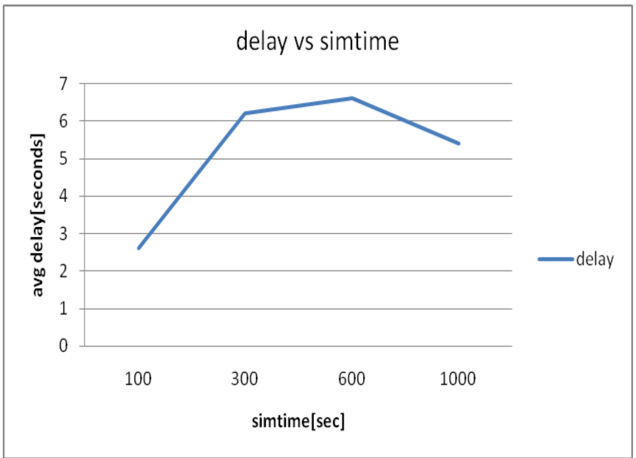


Fig 1-7 delay[s] vs sim time[s]

As the simulation time increases the packet transmission delay in the network decreases.

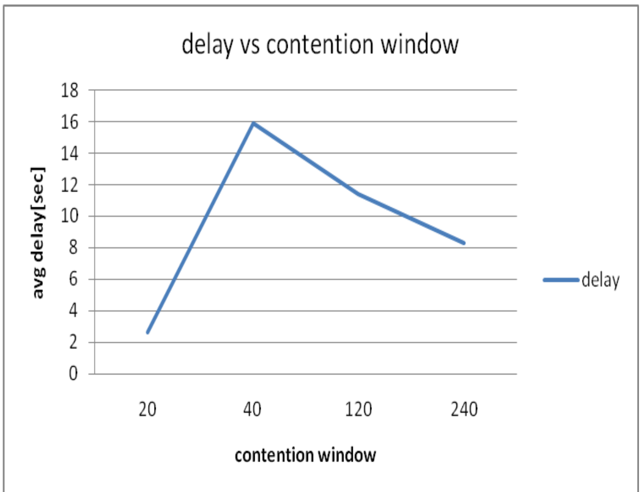


Fig 1-8 delay [sec] vs contention window

As the size of contention window increases the packet transmission delay in the network decreases. Hence the contentio size above 40 will dercreases significantly.

## VII. CONCLUSION AND FUTURE WORK

In VANET the major challenge is finding the accurate position of node because it is very dynamic in nature. Hence The proposed work gives the technique of maximum Position retrieval of nodes is possible to transmit packets and to reduces the network overhead by controlling over flooding of packets , route lifetime etc to obtain more realistic solution for real traffic problem by using position based forwarding routing protocol. Simulation results in urban settings show that position based routing performs best in terms of average packet delivery rate, with up to a 40% increase compared with some existing protocols. In future by including optimized routing the work may be enhanced.

## REFERENCES

[1] Fatemeh Teymoori,Hamid Nabizadeh " a new approach in position based routing protocol using learning automata for VANET city scenario" International Journal of Ambient Systems and Applications (IJASA) Vol.1, No.2, June 2013

[2] Matthew Wilson, and Kishor S. Trivedi "MAC and Application-Level Broadcast Reliability in VANETs with Channel Fading" IEEE Communications Magazine, 978-1-4673.2013

[3] Sardar Bilal, Sajjad Madani," Enhanced Junction Selection Mechanism for Routing Protocol in VANETs" The International Arab Journal of Information Technology, Vol. 8, No. 4, October 2011

[4] K. Egoh and S. De, "A multicriteria receiver side relay election approach in wireless ad hoc networks," in Proc. MILCOM, Washington, DC, Oct. 2006, pp. 1–7

[5] F. Kuhn, R. Wattenhofer, Y. Zhang, and A. Zollinger, "Geometric ad hoc routing: Of theory and practice," in *Proc. 22nd Annu. Symp. Principles Distrib. Comput.*, Boston, MA, Jul. 2003, pp. 63–72.

[6] B. Karp and H. T. Kung, "GPSR: Greedy perimeter stateless routing for wireless networks," in *Proc. 6th Annu. Int. MobiCom*, Boston, MA, Aug. 2000, pp. 243–254

[7] J. Zhao and G. Cao, "VADD: Vehicle-assisted data delivery in vehicular ad hoc networks," *IEEE Trans. Veh. Technol.*, vol. 57, no. 3, pp. 1910–1922, May 2008.

[8] L. Blazevic, L. Buttyan, S. Capkun, S. Giordano, J.-P. Hubaux, and J.-Y. L. Boudec, "Self-organization in mobile ad hoc networks: The approach of terminodes," IEEE Commun. Mag., vol. 39, no. 6, pp. 166–174, Jun. 2001.

[9] H. Wu, R. Fujimoto, R. Guensler, and M. Hunter, "MDDV: A mobilitycentric data dissemination algorithm for vehicular networks," in Proc. 1st ACM Int. Workshop VANET, Philadelphia, PA, Oct. 2004, pp. 47–56.H. Wu, R. Fujimoto,

[10] H. Füßler, J. Widmer, M. Käsemann, M. Mauve, and H. Hartenstein, "Contention-based forwarding for mobile ad hoc networks," Ad Hoc Netw., vol. 1, no. 4, pp. 351–369, Nov. 2003.

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