International Journal of Engineering and Advanced Research Technology (IJEART)
ISSN: 2454-9290, Volume-2, Issue-12, December 2016

Efficient Path Planning Based On Hybrid Routing Protocols over A Vanet

S. Santhana Prabha

***Abstract*— Vehicular Ad-hoc Network (VANET) is an emerging communication Infrastructure which facilitates the connectivity among vehicles through vehicle-to- vehicle (v2v) and vehicle-to-roadside (v2R) communications and is characterized by high dynamic topology of nodes in the network. Due to this high mobility of vehicles it is quite challenging to perform packet delivery from source to destination in case of any destruction or congestion in the network. In order to overcome this problem a novel path planning technique must be implemented reducing packet loss and end to end delay which includes communication among vehicles, road side units(RSUs) and vehicle traffic servers. Hence we propose a routing protocol with GPS and map aware capabilities that includes four metrics such as distance to destination, vehicle's density, vehicle's trajectory and available bandwidth in order to make forwarding decisions. This protocol is being justified and it is shown that it reduces packet loss and end to end delay in the network thus increasing the efficiency of routing.**

***Index Terms*— Routing, Vehicular ad-hoc Network, AODV, GPS**

I. INTRODUCTION

Vehicular ad-hoc network (VANET), a subclass of mobile ad-hoc networks (MANETs). These networks have no fixed infrastructure and instead rely on the vehicles themselves to provide network functionality. VANETs have particular features like: distributed processing, greater number of nodes, the speed and distribution of the nodes, highly varying network topology and certain conditions for communication among nodes. Due to these constraints VANETs characteristics greatly differs from MANETs. VANET is one of the most important fields of research that includes an Intelligent Transportation Systems ITS to ensure autonomous communication between vehicles on the road for the purpose of traffic management, safety alerting or infotainment.[1]

Recently there has been increasing interest in exploring computation and communication capabilities in transportation systems and hence many automobile manufactures started to equip GPS, digital map and communication interfaces. Intelligent vehicular ad hoc networks use WiFi (WAVE standard) for easy and efficient communication between vehicles that exhibit dynamic mobility.[2] Effective measures such as media communication between vehicles can be enabled as well methods to track automotive vehicles.

Routing of data in a vehicular ad hoc network is a challenging task due to the high dynamics of vehicle nodes in the network. Recently, it was shown for the case of highway traffic that position-based routing approaches can very well deal with the high mobility of network nodes. However, basic position-based routing has difficulties to handle two-dimensional scenarios with obstacles (buildings) and avoids as it is the case for city scenarios. Hence to enhance the adaptability of path planning, it is indispensable to know how to efficiently collect and exploit the traffic information for routing and congestion avoidance. AODV and DSR, use broadcast method to discover routes from a sender to receiver. [10]

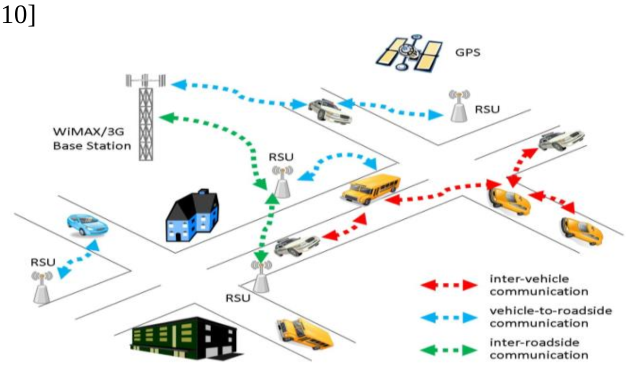

Figure 1. Routing in a VANET

Figure 1.depicts the process of routing in a VANET. It shows how the vehicle nodes communicate with the road side units (RSUs) and other vehicles along the road side thus summarizing concept of the Intelligent transportation System

II. RELATED WORKS

This section briefly describes about some works related to various routing strategies for Vehicular ad-hoc Networks.

A. Multi Hop Broadcast Routing In Vanets

Vehicular Ad-Hoc Networks (VANET) helps to improve the traffic safety by exchanging information between each other. The Routing protocol for multihop broadcast helps to provide efficient routing in broadcast communications. This protocol has some routing overhead in different network scenarios. Here in the proposed method the network traffic is reduced using the congestion control mechanism and it performs well as compared with the existing protocols. AODV and DSR, use broadcast method to discover routes from a sender to receiver. This protocol combines local spatial distribution information and other factors with the distance method heuristic to select rebroadcasting nodes. This paper combines a congestion control mechanism with the Routing protocol and results an efficient routing method for broadcasting. [9]

B. SPRING Protocol

In vehicular ad hoc networks (VANETs), improving uploading efficiency is crucial to enabling the copious applications such as reporting sensed data for traffic management or environment monitoring. In this paper, we propose a social-based privacy- preserving packet forwarding protocol, called SPRING, for vehicular delay tolerant networks. By exploring the mobility diversity among vehicles, a two-hop forwarding scheme is proposed to increase the throughput performance capacity. In SPRING, Roadside Units (RSUs) deployed along the roadside can assist in packet forwarding to achieve highly reliable transmissions. Based on the social degree information, we then tactically place RSUs at some high-social intersections. In addition, detailed security analyses show that the proposed SPRING can achieve conditional privacy preservation and resist most attacks existing in vehicular DTNs. This paper outperforms and can achieve conditional privacy preservation and resist most attacks existing in vehicular DTNs. It leads to packet delay and control overhead. The proposed scheme results in an enhanced throughput performance. It does not deal with problems of end to end delay analysis and packet delivery ratio. [13]

C. Intervehicle-communication-assisted localization

Vehicle localization is a major problem that has recently concerned attention in a wide range of applications. Examples of emerging applications with a great demand for location information are vehicle tracking and location based service. Intervehicle-communication-assisted localization is a localization technique that takes advantage of the emerging vehicle ad hoc networks environments. The relative vehicle location is computed based on the communication among vehicles and is integrated with the movement and location estimates leading to highly accurate vehicle localization. It improves the robustness and accuracy of vehicle location but sometimes prolonged multipath may lead to degradation of accuracy. [11]

D. Geocast Routing Protocol

Geocast routing which consists of routing a message from a unique source vehicle to all vehicles located in a well geographically defined destination area called ZOR (Zone Of Relevance). This work introduces some existing Geocast routing protocols for VANETs as well as a classification of these protocols based on the relay selection techniques they use in routing. It reduces message overhead yet fails to provide an optimized route. [12]

In the proposed system the above addressed issues are reduced by including additional metrics thus increasing the efficiency.

III. PROPOSED WORK.

In the proposed work we introduce a novel routing strategy for routing of these vehicles in case of any congestion in the network. In order to reduce the issues of broken links, packet delay ratio and end to end delay. We propose a GPS based AODV routing protocol (GBAODV) along with some map aware capabilities. In order to find the optimal route it improves the decision of the next forwarding node based on four routing metrics which are the distance to destination, the vehicles' density, the vehicles' trajectory and the available bandwidth hence making the protocol map aware.

GBAODV routing protocol includes two main features

1) It minimizes the number of RREQs by restricting the flow of unwanted packets in the network.

2) It decides the route with respect to the position and velocity of the source, intermediate and destination nodes. The route with higher stability is chosen.

Algorithm for Broadcasting Route Request

'd' is the distance between previous node and current node and 'M' is the maximum transmission distance. The broadcasting algorithm is as follows:

If(d<M || d>M && (d is increasing))
Drop Request Packet;
else
Forward Request Packet;

Figure 2.depicts the system flow diagram of the proposed system. Vehicle point defines that each node in the network is treated as a vehicle moving at a specific speed. The data path defines the moving path of the vehicles and RSUs are maintained for the provision of sending periodic signals to the vehicles. If no traffic information is found then the vehicle reaches the destination using the predefined path present. In case of any congestion a specific routing protocol has to be incorporated and an alternate optimized route must be provided for the vehicles. Here we have used GBAODV routing protocol. Additionally map aware capabilities are being included for increasing the efficiency of forwarding decision and an alternate route is provided for the vehicles reaching the destination.

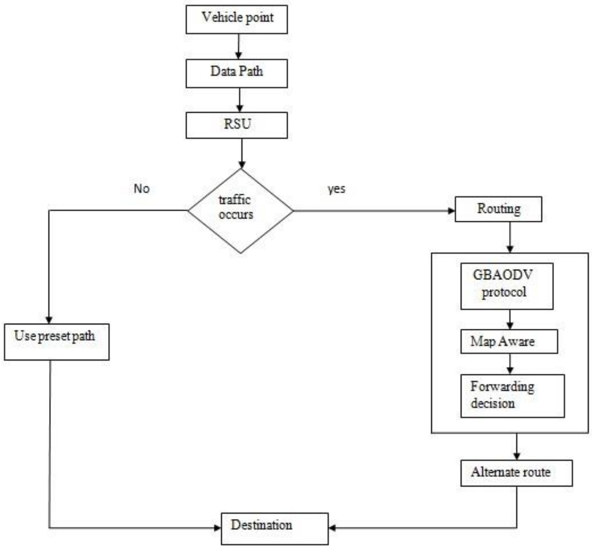

Figure 2.System Flow Diagram of Proposed System

The GBAODV routing protocol is further enhanced with map aware capability in order to increase the efficiency of routing. It evaluates four metrics such as distance to destination, vehicle's density, vehicle trajectory and available bandwidth of every node to make a better forwarding decision. The inclusion of map aware capability evaluates two conditions.

1)It takes into account the presence of obstacles such as buildings and trees in their way to destination and forward packets only to those nodes that are actually reachable.

2) If a proper forwarding node is not found then the packet is temporarily stored in a local buffer.

A. Signaling

In geographic routing protocols each node must intimate their presence to the neighboring node within their transmission range. This signaling process is achieved by exchanging hello messages with neighbor nodes. The format of the hello message includes the identifier, position and velocity of each node. Antenna sensing is measured in decibels (dBm) and a signal power below antenna sensing is not detectable. The velocity of the vehicle at two position (x_1, y_1) and (x_2, y_2) at time t_1 and t_2 is calculated as

$$V_x = x_2 - x_1/t_2 - t_1 \ , \ V_y = y_2 - y_1/ t_2 - t_1 \qquad (1)$$

Algorithm to update neighbor list
Parameters: ID, lx, ly, vx, vy, S, tidle,.
if (The neighbor is already in the neighbor list) then
Update neighbor information
else
if (Reception power _ antenna sensing + 1 dB) then
Add node in the neighbor list
else
Ignore hello message
end if
end if

The four metrics are evaluated as follows

B. Distance

In routing protocols the packets are forwarded on hop by hop basis and so the neighbor that is closest to the destination is chosen as the next forwarding node. In such cases the position of packet's destination and next hop candidates are enough to transfer the packet. The distance to destination is calculated by knowing the destination position (x_d, y_d) with the help of each neighbor node position (x_i, y_i). The Euclidean distance is calculated as follows.

$$d_i((x_i , y_i) , (x_d , y_d)) = \sqrt{(x_i - x_d)^2 + (y_i - y_d)^2} \qquad (2)$$

C. Vehicle Trajectory

Due to high mobility of vehicles in VANET, the communication link is a operative for a short time and hence it is necessary to track the location of nodes at every point of time for efficient delivery of packets to the destination. Once the vehicle moves its location is required to be updated.

D. Density

In VANETs density refers to the list of neighbor nodes corresponding to each vehicle at a particular time and it is denoted as (N_{ne}). Each node calculates the density based on the transmission range (T_x) as follows

$$P_i(t) = N_{ne}(t)/T_x \qquad (3)$$

The node with high density of nodes is given higher score and these nodes forward packet in a better way without any loss until it reaches maximum traffic density.

E. Bandwidth

In VANETs bandwidth is included as a metric in order to improve the quality of service of the protocol and it is estimated using an approach called available bandwidth estimator. It establishes the link between two nodes in the network. The Percentage of idle item of every node is sensing the wireless medium periodically and it is included along with the hello message. The probability of packet collision is estimated as follows

$$P_m = f(m)\, P_{hello} \qquad (4)$$

Every node calculate the available bandwidth for every neighbor node 'i' and 's' is considered as the current forwarding node that establishes the link.

$$ABC_i = (1-k).(1-p_m).T_s.T_r.C \quad (5)$$

IV. EXPERIMENTAL RESULTS

This section briefly discusses the experimental performance of our routing protocol through simulation results. To achieve this Network simulator (NS2-2.35 version) is used.

A. Simulation Setup

In the simulation, the nodes are arranged in a 1500 meter x 1500 meter square region for 60 seconds of simulation time. Each node moves randomly in this area with no pause time. A simulation network with 22 nodes is considered. All nodes in the network have the same transmission range of 200 meters and the initial energy of the nodes is set as 1000 Joules.

B. Performance Metrics

In our experiment, the performance metrics such as end to end delay, packet loss are measured. The simulation results are described in the next section.

C. Results

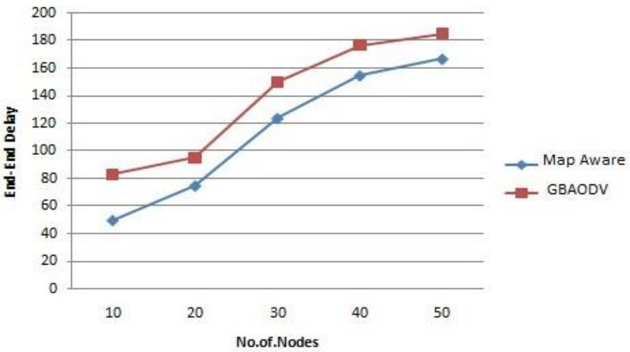

Figure 3. No of nodes Vs End-End delay

Figure 3 shows the average end to end delay incurred during routing. It shows that the average end to end delay of node increases with increasing number of nodes but this is considerably reduced in comparison with GBAODV routing protocol due to the inclusion of map aware capability in it.

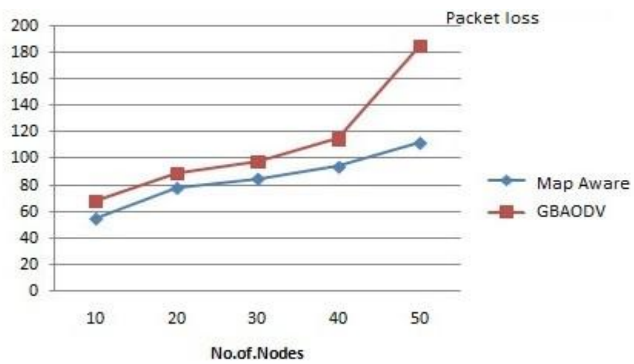

Figure 4 No. of nodes Vs packet loss

Figure 4 shows the packet loss with respect to increase in number of nodes. The packet loss of GBAODV routing protocol is minimized by the inclusion of map aware capability in it.

V. CONCLUSION

In this system the routing of vehicles in a VANET has been explained and AODV routing protocol has been implemented along with GPS and map aware capability thus forwarding the packets to the destination. By doing so the issues of VANET such as packet loss and average end to end delay have been minimized to a greater extent by avoiding the forwarding of packets to unreachable node and it also implements some mechanisms to overcome the problem of bandwidth consumption and packet delivery ratio thus resulting in an efficient routing.

REFERENCES

[1] KavitaRawat and JyotiHati, 2014 "Vehicular Ad hoc Network" International Journal of Information & Computation Technology. ISSN 0974-2239 Volume 4, Number 9 (2014), pp. 941-946

[2] Bijan Paul, Mohammed J. Islam, 2012 "Survey over VANET Routing Protocols for Vehicle to Vehicle Communication," IOSR Journal of Computer Engineering (IOSRJCE), ISSN: 2278-0661, ISBN: 2278-8727, vol. 7, Issue 5 , pp. 01- 09.

[3] R. Manoharan and S. L. P. P. Thambidurai, 2008 "Energy efficient robust on-demand multicast routing protocol for Ad hoc Networks" International Journal of Ad Hoc and Ubiquitous Computing, Vol. 3, pp. 90-98.

[4] Xiao, D.; Peng, L.; Asogwa, C.O.; Huang, L. 2011 " An improved GPSR routing protocol". International Journal on Advance Computer Technology.Vol 3, 132–139.

[5] Ohta, Y.; Ohta, T.; Kohno, E.; Kakuda, Y."2011 "A Store-Carry-Forward-Based Data Transfer Scheme Using Positions and Moving Direction of Vehicles for Vanets". In Proceedings of the 10th International Symposium on Autonomous Decentralized Systems, Tokyo, Japan, 23–27 pp. 131–138.

[6] Tao Song, Wei Xia, Tiecheng Song, LianfengShen, 2010 "A Cluster-Based Directional Routing Protocol in VANET", International Conference on Communication and Mobile Computing.

[7] Rose Babu, R Chandrasekaran, 2014," An Efficient Routing With Congestion Control Protocol For Multihop Broadcast Routing in Vanets", International Journal Of Advanced Computational Engineering And Networking, Issn: 2320-2106, Vol-2, Issue-3.

[8] Charles Harsch, Andreas Festag, PanosPapadimitratos , 2007, "Secure Position-Based Routing for VANETs", IEEE 66th Conference on Vehicular Technology ,*Page*(s): 26 – 30, ISBN: 1090-3038.

[9] Zhaomin Mo, Hao Zhu ; Kia Makki ,2006,"MURU- A Multi-Hop Routing Protocol for Urban Vehicular Adhoc Networks",Mobile and Ubiquitous Systems: Networking & Services, Third Annual International Conference on 10.1109/MOBIQ.340406 pp: 1-8.

[10] MarwaAltayeb ,ImadMahgoub , 2013 ," A Survey of Vehicular Ad hoc Networks Routing Techniques" ,Innovative Information Science & Technology Research Group (ISYOU) ,pp: 1-17.

[11] Drawil, N.M., Basir, O.,2010," Intervehicle-Communication-Assisted Localization", Intelligent Transportation Systems, IEEE Transactions on Vol: 11 , Issue: 3 ,pp: 678 – 691.

[12] Ramakrishna M, 2012,"DBR: Distance Based Routing Protocol for VANETs",International Journal of Information and Electronics Engineering, Vol. 2, No. 2.

[13] RongxingLu , Waterloo, ON, Canada ; Xiaodong Lin ; Xuemin Shen,2010," SPRING: A Social-based Privacy-preserving Packet Forwarding Protocol for Vehicular Delay Tolerant Networks", INFOCOM, Proceedings IEEE Transaction, Page(s): 1 – 9.

S. Santhana Prabha, Department of Computer Science and Engineering, PSNA College of Engineering and Technology, Dindigul.