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Design of an Adaptive Sign Based Routing Protocol in VANET for Sophisticated Environments

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***Abstract:** With the advancement in the communication technology and an increase in the number of vehicles, the Vehicle Ad hoc Network (VANET) has become an emerging field of study. The major applications of VANETs are in highways, but in sophisticated environments such as forest area, hill stations, private museum or large park etc., where visitors across the country pass through several locations, and there doesn't exist a proper communication among the vehicles. So in this type of locations, we need an intelligent routing strategy for the On Board Unit (OBU) to adapt and communicate with the neighbouring vehicles. In this paper, a strategy is proposed where in, the vehicles communicate with each other or with the road side units (RSU) by passing some sign bits with positive or negative polarity. A simple simulation is performed on 100 to 200 vehicles demonstrating passing of data from source to destination.*

***Keywords:** OBU, Sign, Location, Routing Protocol, Path.*

I. INTRODUCTION

With the fast development of roads and highways, it has become convenient for people to travel to different locations across the country. Hence, with an increase in a number of vehicles brings a heavy load on the traffic system. Intelligent Transportation System (ITS) provides many facilities to the travellers, such as safety measures, exchange of messages with other vehicles, emergency warning, etc. Vehicular Ad-Hoc Network (VANET) is a vital part of the ITS, which encapsulates sensor technology, short range communication, and information processing technology [1]. VANETs have several characteristics that make it different from Mobile Ad Hoc Networks (MANETs); such as high node mobility, predictable and restricted mobility patterns, rapid network topology change, and unlimited power supply. In VANET, vehicles are fitted with On-Board-Units (OBUs) that can communicate to other vehicles as Vehicle to Vehicle communication (V-to-V), and also with Road Side Infrastructure (RSU) units (V-to-R).

Earlier MANET routing protocols such as Dynamic Source Routing (DSR [2]) and Ad-hoc On demand Distance Vector (AODV [3]), where applied for VANET scenarios, but the result showed a high throughput and Packet Delivery Ratio (PDR), when the speed and distance between the nodes are close to each other. The Optimized Link State Routing (OLSR) protocol gives higher link duration and route stability than Destination-Sequence Distance-Vector (DSDV) protocol, due to Multi-Point-Relay (MPR) mechanism that is used in OLSR. In general, when the distance and the speed between the communicating nodes are relatively high, these two protocols produce low PDR and a high number of link failures [6]. Thus, it is not suitable to make use of these protocols in VANET environment.

Different kinds of routing protocols were proposed by many researchers for VANET such as proactive, reactive, hybrid , and geographic-based routing protocols[6].The proactive and reactive routing protocols are classified under the topology based routing protocol category, which aims to discover the route between the source and destination before starting the data transmission.
Vehicles moving on some sophisticated areas with tough and rough roads like hill stations or forest areas are more likely to cause accidents due to many turns, curves and zigzag roads.

In this paper, we propose a new routing protocol for VANET called ASBR (Adaptive Sign Based Routing) Protocol.
As the name implies, it's a routing protocol which is based on assigning signs or polarity to the participating nodes. In this protocol, the geographic area is divided based upon these signs that the vehicles hold on the OBU. The greatest advantage of ASBR protocol is that it adapts dynamically according to the neighbouring vehicles sign. It also reduces the overhead and packet delivery delay when transporting a data packet to the destination node. It increases the packet delivery ratio and saves the memory space of caching the routing table.

The rest of this paper is organized as follows; in section II we provide an overall system description. We introduce the related works about the routing protocols in Section III. The main idea of the ASBR protocol is discussed in section IV.The simulation results, analysis, and conclusion are shown in section V and VI.

II. SYSTEM DESCRIPTION

A. Application Scenario

Figure 1 shows the application scenario of OBUs in the VANET. Vehicles are all equipped with OBUs. The RSUs are fixed on the roadside every half kilometre, and all these units are connected to the central control centre (CCC). The wireless connection between the RSU's and the Vehicles are based on the DSRC standard. The control centre can collect information like the geometry of a coming cross, electronic map, and the existence of an obstacle [5]. Then it will forward this information to OBU equipped vehicles within its range through the RSU. Vehicles also transmit the state information to RSUs.

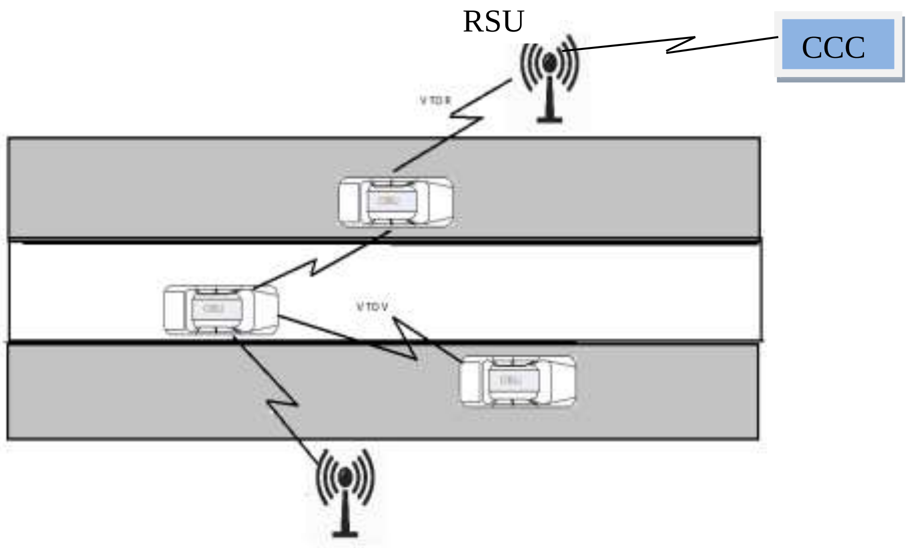

Fig. 1: Application Scenario of VANET Equipped with OBU

B.OBU Functionality

To implement the system functions, the design diagram is shown in Figure 2. The OBU consists of, wireless communication module (WCU), GPS module, and User interface module. The central control module includes Converter Unit, Processing Unit (PU), serial port processing, data transceiver and memory.

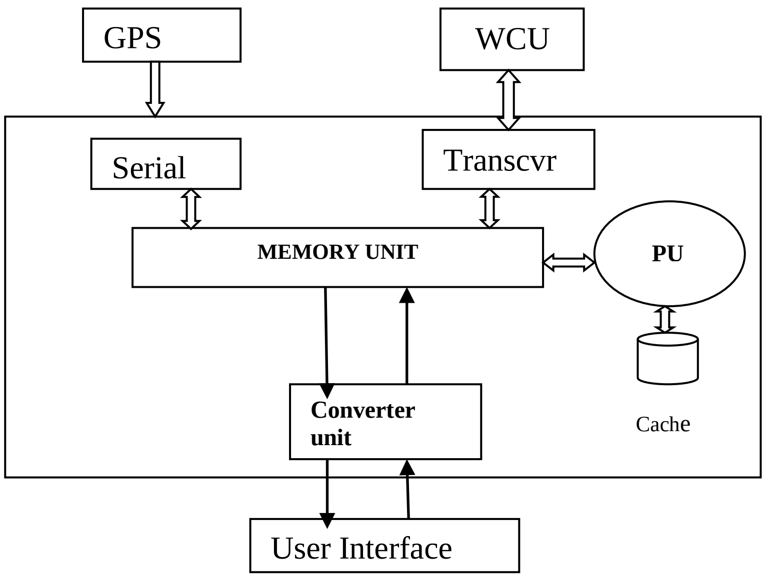

Fig. 1 Block Diagram of OBU

Every OBU equipped vehicle transmits its vital information at regular intervals which are obtained from GPS unit. These include the location of the vehicle, its speed and road details. Other vehicles receive these messages to determine the path. Whenever the vehicle receives a warning message, the OBU will take action to alert the driver.

III. TYPES OF ROUTING PROTOCOLS

Routing in VANET is very difficult due to rapid vehicles mobility and dynamically changing network topology. These protocols are grouped based on the application and location where they are most suitably used. Routing protocols in VANET are classified as follows:

A. Topology Based Routing Protocols

These protocols make use of the link state information to forward data among the nodes. They are further classified into Proactive [7], Reactive [8-10] and Hybrid [11] [12].

B. Position Based Routing Protocols

These protocols are also called as Geographical routing and are mainly used in that network where nodes are highly dynamic and mobile in nature. They select the next forwarding hops by using this geographic position. Position based routing protocols depend on the position information of the destination node and this information is obtained by the GPS system or by the periodic beacon messages [13]. In this protocol, every node knows its own position and neighbours position and destination node position. So by knowing these positions, no topology of network or previous route discovery is required to send the message from source to destination. IRTIV [14] is a position-based routing protocol that aims to find the shortest connected route to the destination in a city scenario,

C. Cluster Based Routing Protocols

These routing protocols are mainly used for large networks. In this many clusters exists and nodes themselves choose the cluster. In each cluster, any node is selected as a cluster head and then this clusterhead will send the packet to the other cluster. These protocols increase the packet delivery ratio and also save the memory space [15].

D. Geocast Routing Protocols

This routing is based on location and it is a multicast routing. In this routing, the source node sends the packet to every node that exists in the specified geographic region. In this routing, flooding is used to transfer packets. The nodes outside the region are not considered. Intersection-Based Geographical Routing Protocol (IGRP) is a location-based routing protocol [16].

E. Broadcast Based Routing Protocols

In VANET, the broadcast routing is performed better only for a small network. In this routing, the message is broadcast to every node in the network using flooding. In VANET, this routing is mainly used to share road conditions, traffic information, weather and emergency between vehicles [17].

IV. ADAPTIVE SIGN BASED ROUTING PROTOCOL

A. Sign Algorithm

The following section describes the proposed algorithm in the sophisticated zone such as hill station or forest areas.

In this strategy, every node (vehicle) is assigned a sign or polarity. The sign can be either p+ or n-. Vehicles entering at high altitude are given p+, and vehicles travelling at lower altitude are given n- sign. So when ever these vehicles cross, messages are exchanged. Here the OBU acts smartly by recognizing this signs and updating the routing table in its respective cache memory.

Algorithm Sign (V[], PATH[])

Initialize all nodes V={v1,v2,v3,......vj} with basic OBU properties .

Register the vehicles entering the sophisticated zone with positive sign p+.

Initialize PATH []=NULL;

Sign(Vi)

While vehicle Vi is in ON state with p+ sign and wants to communicate with vehicle Vj with an unknown sign, do

a. Broadcast the message only to two nearest neighbouring vehicles with p+ sign
b. Broadcast message to all neighbouring vehicles with n- sign.
c. If Vp=Vj then
   Destination found
   Return PATH;
   else
   Assign Vi := Vp

d. Change vehicle Vp sign from n- to p+.
e. add_path{PATH[Vp]}
f. Sign(Vp)

End while

The PATH vector stores the path traced by the vehicles when data exchange takes place. The nearest neighbours are chosen by simple distance formula calculated using latitude and longitude of the moving vehicle at a particular instance, and is repeated several times by computing its geographical location.

V. SIMULATION RESULTS

By using the realistic vanet simulator in Java and Matlab version R2016b, we evaluate the performance of our algorithm in terms of end-to-end delay and control overhead comparing with simple AODV protocol. The nodes are randomly generated. Every node represents a vehicle.

The vehicle's vital information such as vehicle ID, Speed, Location etc. are displayed while selecting a particular node as shown in figure 3.

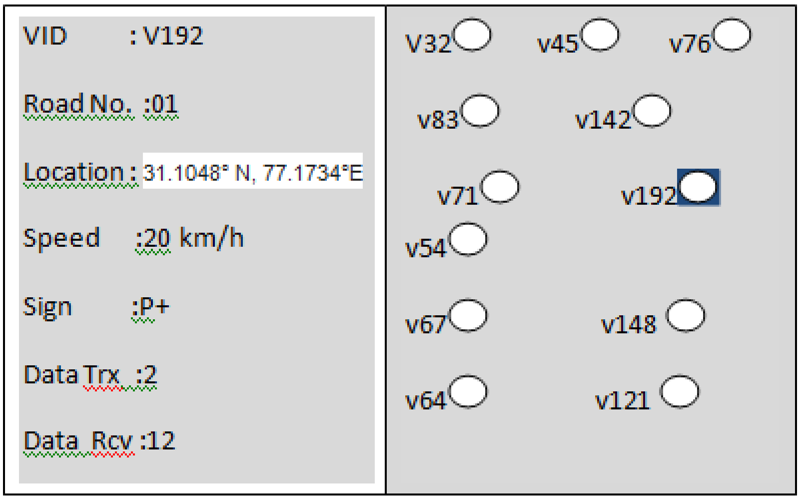

Fig. 3: Vehicle Description

The final path is computed by running the proposed algorithm. As an example, the node V28 wants to transfer data to destination node V72. The simulation computes the path to be V98-V13-V11-V12-V74. The blue dashed line indicates the communication between similar polarities or sign terms.

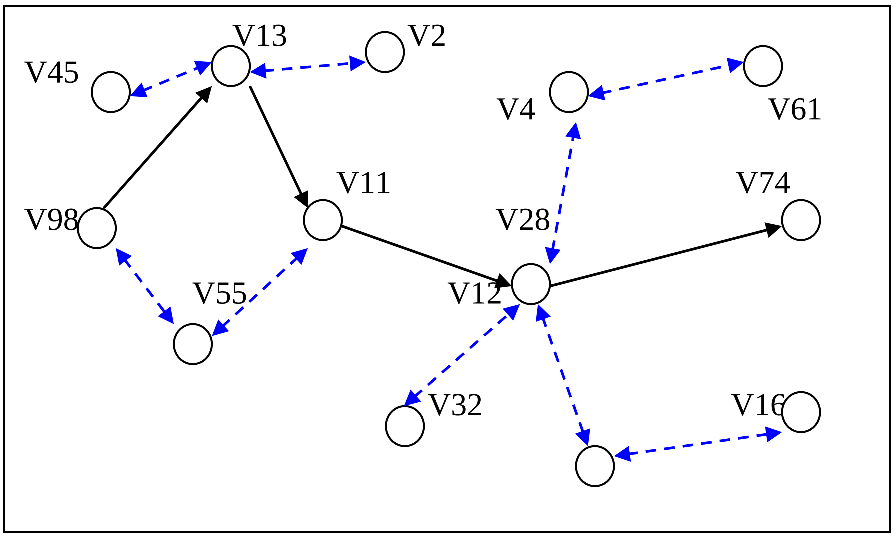

Figure 4 and 5 illustrates the control overhead and end to end delay when compared with the simple Ad-Hoc AODV protocol.

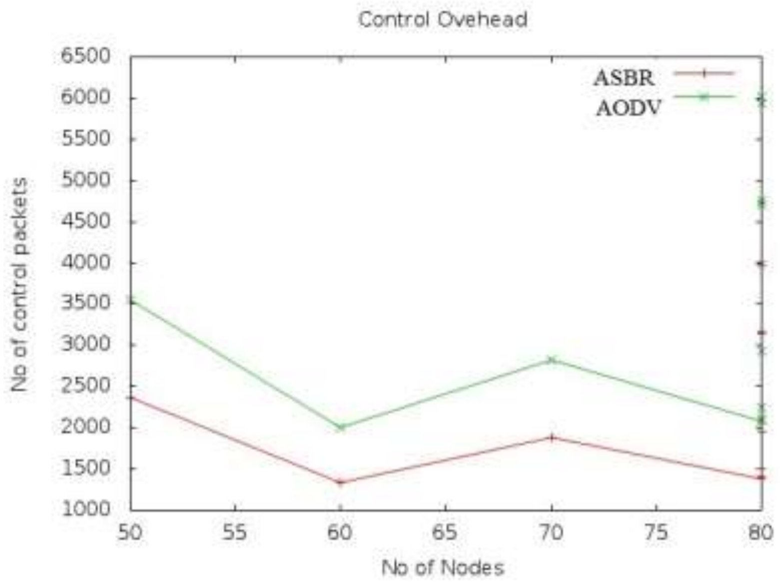

Fig. 4 No. of Control Packets Comparison with AODV

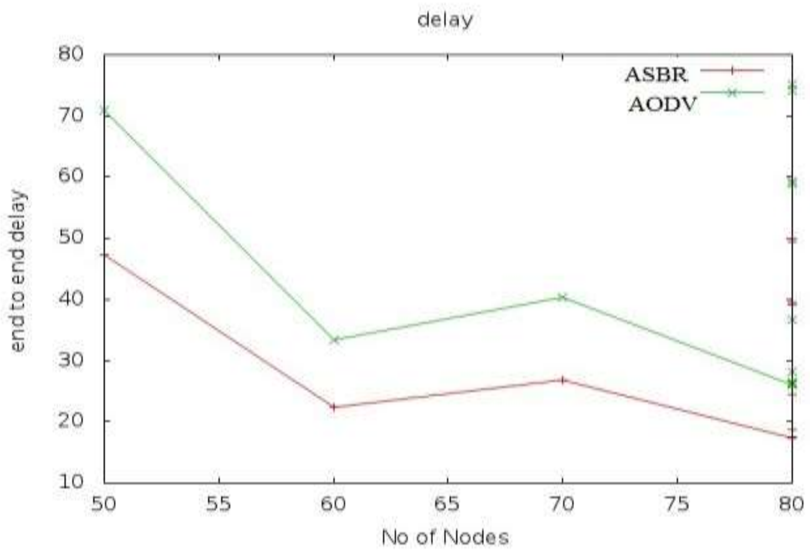

Fig. 5: End to End Delay Comparison with Simple AODV

VI. CONCLUSION

This paper proposes a novel routing protocol for VANET called Adaptive Sign Based Routing Protocol that can be implemented in some sophisticated zones. It is based on assigning signs or polarity to the vehicles. In this protocol, the geographic location is partitioned based upon the directions of the vehicle movement and also based on the altitudes they are travelling. The greatest advantage of ASBR protocol is that it adapts dynamically according to the neighbouring vehicles sign or polarity. It is also shown through simulation results that it reduces the overhead and packet delivery delay when transporting a data packet to the destination node.

REFERENCES

1. Sou S I, Tonguz O K. Enhancing VANET connectivity through roadside units on highways. IEEE Transactions on Vehicular Technology, Vol.60 (8), 2011, pp. 3586-3602.

2. D.B. Johnson and D.A. Maltz, “Dynamic source routing in ad hoc wireless networks,”In Mobile Computing, vol. 353, 1996.

3. C.E. Perkins and E.M. Royer, Ad-hoc on demand distance vector routing, in Proceedings of the 2nd IEEE Workshop on Mobile Computing Systems and Applications[C], pp. 90–100, Feb. 1999.

4. E. Spaho, M. Ikeda, L. Barolli, F. Xhafa, M. Younas, and M. Takizawa,“Performance of olsr and dsdv protocols in a vanet scenario: Evaluation using cavenet and ns3,” in *2012 Seventh International Conference on Broadband, Wireless Computing, Communication and Applications*, Nov2012, pp. 108–113.

5. Q. Yang, L. Wang, W. Xia, Y. Wu and L. Shen, "Development of on-board unit in the vehicular ad-hoc network for highways," *2014 International Conference on Connected Vehicles and Expo (ICCVE)*, Vienna, 2014, pp. 457-462.
6. A. Abuashour and M. Kadoch, "An Intersection Dynamic VANET Routing Protocol for a Grid Scenario," *2017 IEEE 5th International Conference on the Future Internet of Things and Cloud (FiCloud)*, Prague, 2017, pp. 25-31
7. E. Spaho, M. Ikeda, L. Barolli, F. Xhafa, M. Younas, and M. Takizawa,"Performance of olsr and dsdv protocols in a vanet scenario: Evaluationusing cavenet and ns3," in *2012 Seventh International Conference on Broadband, Wireless Computing, Communication and Applications*, Nov 2012, pp. 108–113.
8. B. Ding, Z. Chen, Y. Wang, and H. Yu, "An improved aodv routing protocol for vanets," in *2011 International Conference on Wireless Communications and Signal Processing (WCSP)*, Nov 2011, pp. 1–5. [7]
9. O. Abedi, R. Berangi, and M. A. Azgomi, "Improving route stability and overhead on aodv; routing protocol and make it usable for vanet," in *2009 29th IEEE International Conference on Distributed Computing Systems Workshops*, June 2009, pp. 464–467.
10. X. Yu, H. Guo, and W. C. Wong, "A reliable routing protocol for vanet communications," in *2011 7th International Wireless Communications and Mobile Computing Conference*, July 2011, pp. 1748–1753.
11. C. Wu, S. Ohzahata, and T. Kato, "Can we generate efficient routes by using only beacons? backbone routing in vanets," in *2013 IEEE 24th Annual International Symposium on Personal, Indoor, and Mobile Radio Communications (PIMRC)*, Sept 2013, pp. 2929–2934.
12. R. Chai, B. Yang, L. Li, X. Sun, and Q. Chen, "Clustering-based data transmission algorithms for vanet," in *2013 International Conference on Wireless Communications and Signal Processing*, Oct 2013, pp. 1–6.
13. N. Goel, G. Sharma and I. Dhyani, "A study of position based VANET routing protocols," *2016 International Conference on Computing, Communication and Automation (ICCCA)*, Noida, 2016, pp. 655-660.
14. O. S. Oubbati, N. Lagraa, A. Lakas, and M. B. Yagoubi, "Irtiv: Intelligent routing protocol using real time traffic information in the urban vehicular environment," in *2014 6th International Conference on New Technologies, Mobility and Security (NTMS)*, March 2014, pp. 1–4.
15. Y. Luo, W. Zhang, and Y. Hu, "A New Cluster Based Routing Protocol for VANET," *2010 Second International Conference on Networks Security, Wireless Communications and Trusted Computing*, Wuhan, Hubei, 2010, pp. 176-180.
16. H. Saleet, R. Langar, K. Naik, R. Boutaba, A. Nayak, and N. Goel, "Intersection-based geographical routing protocol for vanets: A proposal and analysis," *IEEE Transactions on Vehicular Technology*, vol. 60, no. 9, pp. 4560–4574, Nov 2011.
17. A. Soua, W. Ben-Ameur and H. Afifi, "Broadcast-based directional routing in vehicular ad-hoc networks," *2012 5th Joint IFIP Wireless and Mobile Networking Conference (WMNC)*, Bratislava, 2012, pp. 48-53.

