An Approach to Utilize Location Information to Improve Performance of Routing Protocols for Ad Hoc Networks Establishment in VANET

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Abstract
The vehicular adhoc network is the type of network in which vehicles can move from one location to another without help of any driver. To establish secure and shortest path from source to destination routing protocols are used which can be categorized into reactive, proactive and hybrid. To reduce chances of link failure, technique of root node selection is applied. When any node wants to establish path to destination, the path must be selected through root node. This reduce the chances of link failure in the network and path establishment process is made easy packet overhead is less in the proposed technique.It focuses at traffic and establishment of path by utilizing the R-optimal paths algorithm. The proposed technique is implemented in NS2 and it is been analyzed that proposed technique performs better in terms of throughput, delay and packetloss.

Keywords:
Utilize Location Information, Routing Protocols, Ad Hoc Networks, VANET

1. Introduction

There are many research studies being proposed on the communication among the vehicles and the road-side units. Vehicular Ad hoc Networks (VANETs) are one of these prominent areas in today's technology era. Without the need of any underlying architecture, the vehicles as well as the elements are connected with each other [1]. They send and receive information along with providing important information such as warnings related to the traffic. For the deployment of VANETs, Wi-Fi IEEE 802.11 based technology is popularly used today. 802.11b or 802.11g are the two standards which are used by the vehicles with wireless network interface for accessing media. The requirements of high dynamic network such as VANETs are not well handled by these general purpose standards. VANETs have a large number of applications. The learning as well designing process of VANETs is a very difficult task. According to the various classes, the set of protocols are used for various applications [2]. VANETs are used for safety applications which involve practical applications such as monitoring the surrounding road, arriving vehicles, road surface and curves, etc. Commercial applications involve giving the driver entertainment and web accessing services, streaming audio and video services etc. The traffic management is dealt through the convenience applications. This is done by increasing the degree of convenience for the drivers [3]. Other productive applications which result in environmental benefits, time utilization and fuel saving are also provided by the VANETs.

To match up the complexity of VANETs, the researchers have developed suitable routing protocols accordingly [4]. The VANET routing protocols have been categorized into six broader classes which are Topology based, Position based, Geocast based, Cluster based, Broadcast based and Infrastructure based. In the topology based protocols, before the sender transmits the data the protocols need to discover the route and maintain the table accordingly. The topology based protocols have a further section of division of protocols into pro-active, reactive and hybrid routing protocols [5]. The table-driven protocols are known as the proactive protocols which periodically exchange the information regarding the topology of nodes throughout the network. Reactive protocols which are also known as the on-demand routing protocols, update the routing table periodically if only there is any data to be sent. Here, flooding process is utilized for route discovery. AODV and DSR are the two examples of this category [6]. The reduction of control overhead of proactive routing

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protocols and the decrement of initial route discovery delay in reactive routing protocols is done by evolving hybrid protocols. In position based routing protocols, the next forwarding hopes are selected by the geographic positioning information. This ensures that there is no further need to create or maintain the global route between source and destination. For transmitting a particular message to all the vehicles available in a pre-defined geographical region Geocast based protocols are used [7]. Another category, in which the vehicles which are closer to each other form a cluster, is known as cluster base routing protocol. Cluster heads are selected which play some important roles in management of the functions.

2. Literature Review

Salim M.Zaki (2012) proposed [8], that the location based services which are used in VANET to locate the position of the node do not distribute the load on multi-servers. In this paper, grey model of accuracy is used for defining the location of the nodes which is affected by the movement of nodes in VANET. The information of the nodes such as the distance of the node to the intersection point and the speed in which the stable location servers are selected is used here. The alpha beta gamma filters are used to predict the next position of the nodes. The prediction algorithm used here, filtered the noise of the data and produced accurate location of the destination. The delivery of packets to the destination is increased in this process and the end to end delay for routing packets is reduced.

Bilal Mustafa Umar Raja (2010) proposed [9] in this paper the different ad hoc routing protocols in VANET. The objective of this paper is to recognize which ad hoc routing method performs better in highly mobile environment of VANETs. The protocols were evaluated using simulation with respect to the performance metrics like throughput and packet drop. MATLAB is used in this paper for plotting graphs of comparing the results for selecting appropriate routing protocols. High throughput and low packet drop is seen in AODV and GPRS in city environment. In highway as well as the city environments, the GPRS shows better performance as compared to the AODV in VANET.

Jonathan Ledy, Herve Boeglen (2009) represent a paper [10], on V-AODV a version of aodv (ad-hoc on demand distance vector) especially created for vehicular ad-hoc networks (VANETs). It is designed for complex cross-layered metrics which are based on delay from mode to node and bit error rate achieved from the physical layer. ns2 simulator is used for the implementation of this techniques. Communication ray tracer, a realistic environment tool is used here. The results show that the basic propagation model is not suitable for the ns2 because of its unsuitability in VANETs. Using the routing metric which is based on delay and BER, the first parameter is more relevant in terms of QoS.

Josiane Nzouonta, Neeraj Rajgure (2009) represent a paper [11], which lists the classes of routing protocols which are used in VANET. A scenario is proposed here which is based on road paths which consist of successions of road intersections. They have a high probability of network connectivity amongst them. For transferring the packets between the intersections of the path and reducing the path sensitivity for individual node movements, the geographical forwarding technique is used. 40% of improvement is shown in this technique by the simulation results. RBVT-P improves the performance up to 85% which is less in the other compared protocols.

Yoshitaka Ohtaki (2006) proposed a paper [12], in which ant based routing algorithm is used. A more reliable, robust and scalable technique is proposed as compared to the other conventional routing algorithms. A scalable ant based routing algorithm is proposed which keeps the paths short. The probability of packet forwarding is updated by using multistep time to the live scheme. It is an effective message as well as a migration scheme proposed for the improvement in existing works. The results show that the proposed algorithm establishes shorter math as compared to the conventional ant based algorithm which has similar signalling overhead.

Young-Bae Ko and Nitin H. Vaidya (2000) introduced a mobile ad hoc network [13], which consists of wireless hosts that may move often. Movement of hosts result in a change in routes, which needs some mechanism to determine new routes. This paper suggests an approach to utilize location information (for instance, obtained using the global positioning system) to improve

performance of routing protocols for ad hoc networks. By using location information, the proposed Location-Aided Routing (LAR) protocols limit the search for a new route to a smaller "request zone" of the ad hoc network. Two algorithms are presented to determine the request zone, and also suggest potential optimizations to the algorithms. This results in a significant reduction in the number of routing messages.

3. LAR Protocol

LAR is on demand routing protocol like AODV and DSR. It utilizes location information of mobile nodes to decrease the routing overhead. LAR scheme only forward the packets in the request zone. It uses position information to send a route request packet (RREQ) to destination in given request zone. Consider a node S (sender) has to find a route to node D (destination). The node can only transmit the data to the other node if it belongs to the request zone. If node wants to send the packet to others, then area should be the expected zone. Otherwise packet will only transmit in the request zone. In LAR, there are two zones present: expected zone and request zone. LAR uses flooding like DSR to discover the route but flooding is restricted to a certain area called "request zone". It uses location information to flood a route request packet for destination in request zone instead of in the entire ad hoc network.

It is possible that the destination will not receive a route request message (for instance, when it is unreachable from the sender or route requests are lost due to transmission errors). In such cases, the sender needs to be able to re-initiate route discovery. Therefore, when a sender initiates route discovery, it sets a timeout. If during the timeout interval, a route reply is not received, then a new route discovery is initiated (the route request messages for this route discovery will use a different sequence number than the previous route discovery – recall that sequence numbers are useful to detect multiple receptions of the same route request). Timeout may occur if the destination does not receive a route request, or if the route reply message from the destination is lost. Route discovery is initiated either when the sender S detects that a previously determined route to node D is broken, or if S does not know a route to the destination.

4. Research Methodology

In the proposed technique, in the whole network we define some nodes which are root nodes, under these root nodes we will defines the leaf nodes. The leaf node comes under which root that will be decided by prediction based technique for multicasting. The Root nodes are responsible to maintain the tree on the basis of distance between the nodes. The root nodes can maintain routing table and in this routing table information about their leaf nodes are stored. The root nodes can send the stored information to RSU's and before requesting for the path to destination. The source node communicates with the RSU and RSU give information about the leaf node for path establishment by using R-optimal paths algorithm. The source node send route request packets to only those root nodes, which have access to desired leaf node. The broadcasting technique will increase delay in the network and network resource utilisation increase at fixed rate. To reduce delay in the network, the technique of multicasting had been proposed. The following are various assumptions of the proposed technique

1. The network will be placed with the finite number of nodes and roads structure already defined
2. Every node are responsible to manage the table of its adjoining nodes

R-optimal path algorithm

```
Set M Mobile Node's
Set S sender and R receiver
Node Routing = AODV
Set Route
{ If (route found(from S to R))
 { Checking resistance of route;
If (route => 1)
 {
Searching for nearest nodes
Trying to establish path through root node

root node is transmiting acknoledgement }
}
Else {destination host  "unreachable"} } {
Creation of new node(root);
```

{
Data sending between source to destination by using root node
{
Q++;
Saving the receiving data;
} destinator pickss data from I
node;
retrieve back to sender by ACK ; } }}

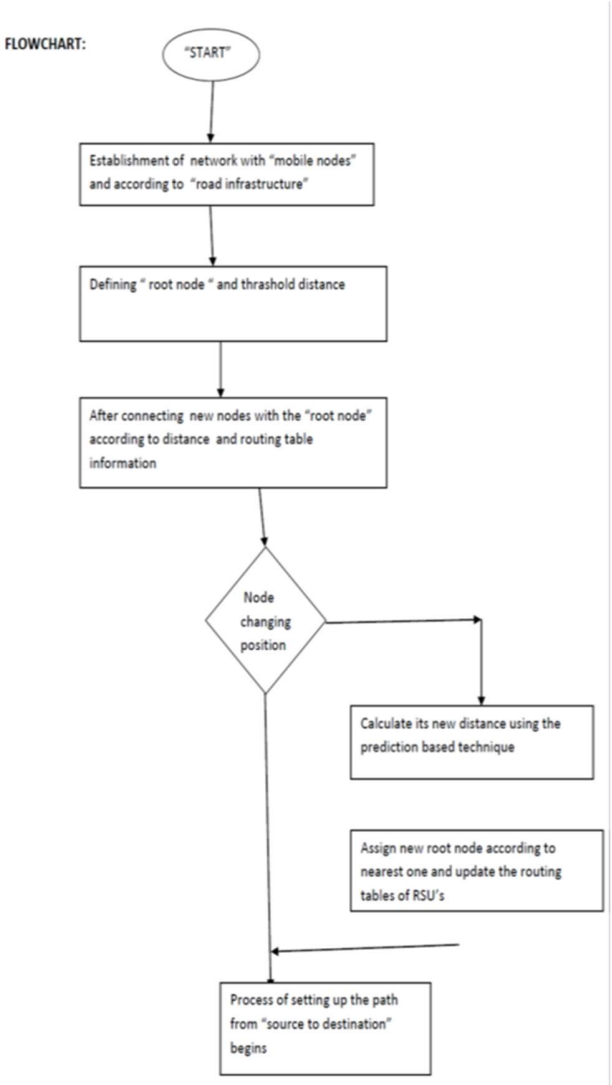


Figure 1 R-optimal path algorithm Flow

5. Experiment Results

Time	(AODV) Existing Algorithm	(E-AODV) Proposed Algorithm
2 seconds	8 Packets	10 Packets
4 Seconds	32 packets	60 packets
6 seconds	35 packets	66 packets
8 packets	58 packets	68 packets

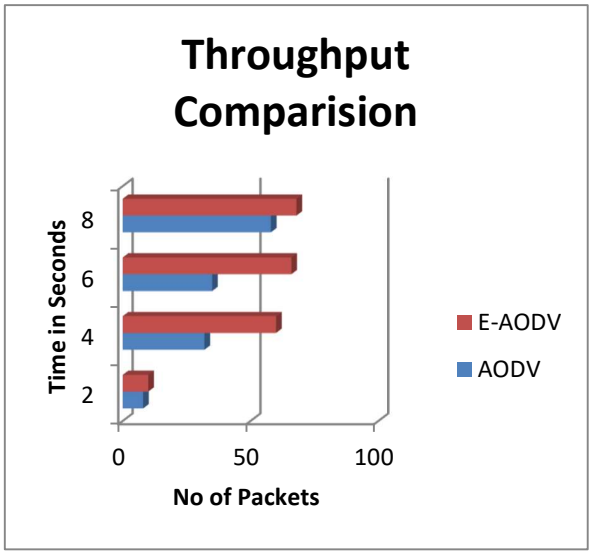


Figure 2 Throughput Comparison

As shown in Figure 2, the technique of broadcasting is applied for the path establishment which is existing algorithm and technique of multicasting is applied which is the proposed algorithm for the path establishment in the network. This leads to increase the network throughput which is illustrated in the figure.

Table 1 Comparison Analysis over existing algorithms

Time	(AODV) Existing Algorithm	(E-AODV) Proposed Algorithm
2 Seconds	10 Packets	9 Packets
4 Seconds	53 Packets	32 Packets
6 Seconds	66 Packets	68 Packets
8 Seconds	120 Packets	100 Packets

Time	(AODV) Existing Algorithm	(E-AODV) Proposed Algorithm
2 seconds	14 Packets	4 Packets
4 seconds	23 Packets	15 Packets
6 seconds	24 Packets	18 Packets
8 Seconds	26 Packets	19 Packets

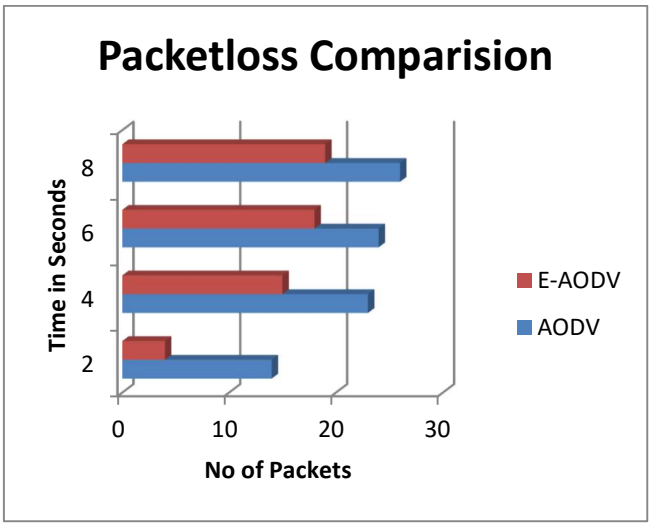


Figure 3 Packet loss Comparison

As shown in the Figure 3, the proposed and existing techniques are compared in terms of packetloss. It is been analyzed that packetloss of the proposed is less and compared to proposed technique.

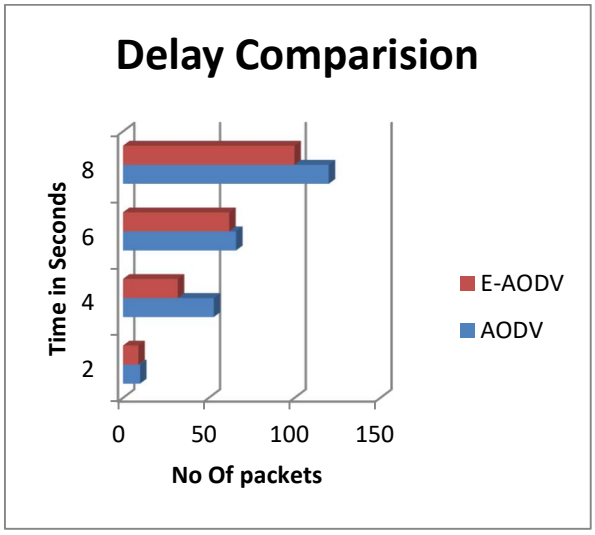


Figure 4 Delay comparison

As shown in Figure 4, the proposed and existing techniques are compared in terms of delay. The delay in the proposed technique is less than the existing scheme due to multicasting approach is used for the path establishment.

6. Conclusion

This research is based on routing issue in which two type of communication is possible; the first type of communication is V2V and second type of communication of V2I. In this work, multicasting technique will be proposed in which source node flood the route request packets to the node which has maximum possibility to establish path to destination. The propose improvement leads to reduction in packetloss, delay and increase in network throughput.

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