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RESEARCH ARTICLE

LOCATION AWARE ADAPTIVE ROUTING PROTOCOLS IN VANETS

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ABSTRACT: Vehicular Ad hoc Network (VANET) is an ad hoc network composed of highly mobile vehicle nodes. A new routing protocol Modified Geographic Routing Over VANET (MGROOV) is proposed to improve the efficiency of VANETs in terms of Packet Delivery Ratio (PDR) and Average End to End Delay. We introduce the use of connection reliability, distance factor and direction as factors for the selection of relay node. On simulation using ns-2 results show that proposed work achieved high level of efficiency in both city and highway scenario when compared to AODV and DSDV

1. INTRODUCTION

1.1 Ad-Hoc Networks:

An ad hoc network is defined as "... an autonomous system of routers (and associated hosts) connected by wireless links—the union of whose form an arbitrary graph. The routers are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. Such a network may operate in a standalone fashion, or may be connected to the larger Internet operating as a hybrid fixed/ad hoc network."

A wireless ad hoc network is a decentralized type of wireless network. The network is ad-hoc because it does not rely on a pre-existing infrastructure, such as routers [1]. Instead, each node participates in routing by forwarding data for other nodes, and so the determination of which nodes forward data is made dynamically based on the network connectivity. It is Client-Client or Peer-Peer model.

1.2 Vanets:

VANETs stand for the Vehicular Ad-hoc NETworks. A VANET is effectively a subset of MANETs. A MANET is a self forming network, which can function without the need of any centralized control. Each node in an ad hoc network acts as both a data terminal and a router [2]. The nodes in the network then use the wireless medium to communicate with other nodes in their radio range. The benefit of using ad hoc networks is it is possible to deploy these networks in areas where it isn't feasible to install the needed infrastructure. Another benefit of ad hoc networks is they can be quickly deployed with no administrator involvement. The administration of a large scale vehicular network would be a difficult task. These reasons contribute to the ad hoc networks being applied to vehicular environments.

2. RELATED WORK

In VANETs, the main aim of the routing protocols is to increase the packet delivery ratio and decrease the end to end delay. Each vehicle in the network is equipped with GPS to obtain its location information. Every vehicle knows its own coordinates. The source vehicle packets its own position into beacon message so that the neighboring vehicles forward packets to the destination according to the beacon message. In a fixed time interval, each vehicle exchanges the information of the neighboring vehicles and updates the neighbor list tables by beacon messages. Here, the neighboring vehicle means the one-hop neighbor. The packet delivery ratio and end to end delay depend upon the beacon interval. If the beacon interval is low then the redundancy increases leading to high end to end delay although it might increase the PDR a bit. On the other hand to decrease the end to end delay if beacon interval is kept high the PDR decreases. The beacon interval is decided on the basis of the environment in which the vehicle is, whether it is in city environment or the highway environment. In the city scenario the density of the vehicles is quite high and in case of the highway scenario the density of vehicle is quite less. The current routing protocols can’t sense the changing scenarios so also can’t adapt to them. As result it might lead to packet dropping, increasing end to end delay, decreasing PDR. To overcome these problems we have proposed a new protocol that will adapt itself to changing road environments. In addition to the position, velocity and direction attributes of the beacon message, two addition variables will be used. In order to incorporate the past behavior of a node into relay node selection criteria to increase the probability of message delivery, a new parameter is added i.e. connection reliability. This will be predicted on the basis of the speed variations of the vehicle. To minimize the chances of packet dropping resulting from the movement of the chosen node outside the relay node’s transmission range another parameter is introduced i.e. distance factor.

Position Routing Protocol:

Position based/geographic routing employs the awareness of vehicle about the position of other vehicles to develop a routing strategy.

The Position based routing protocols such as GPSR, GSR, SAR combine the position information with topological knowledge about the road and the surroundings. The idea is to build a spatial model representing the underlying road topology and select a routing path that overlaps with the streets. For this purpose, graphs are used to represent road maps where vertices are crossroads and edges are road segments. The edges of the graph are weighted with static data extracted from the street maps.

3. PROPOSED WORK:

In this thesis a new position based routing has been introduced with the aim of increasing the packet delivery ratio and to decrease the end-to-end delay. We have analyzed, simulated it and comparison has been drawn to earlier position based routing protocol in order to show how the proposed algorithm is better and efficient than the earlier ones. The main focus of the thesis structure is to calculate the most accurate position coordinates and the routing of the packet in correct direction of the destination so that minimum number of hops is required that will also decrease end-to-end delay.

Two new parameters are introduced namely:

Connection Reliability: to increase the probability of message delivery.

3.1 Algorithm For Calculating Connection Reliability(R):

STEP1. If the node is new in the neighbor table, then

Set R: =3,

Else

Go to next step.

STEP2. If the change in speed is ±5 to ±10, then

R remains same,

Else

Go to next step.

STEP3. If the change in speed < ±5, then

If R < 5, then

Set R: = R+1

Else R remains same.

Else Go to next step.

STEP4. If the change in speed > ±10, then

If R > 1, then

Set R: = R -1

Else R remains same.

Else Exit.

Distance Factor- To minimize the chances of packet dropping.

3.2 Algorithm To Find The Distance Factor (D):

STEP1. Set the transmission range of the node to be T.

STEP2. Divide the transmission range of the vehicle in to five regions with boundaries T/5, 2T/5, 3T/5, 4T/5, T.

STEP3. If the neighboring node lies in the region T/5, then

Set D: =1,

Else

Go to next step.

STEP4. If the neighboring node lies in the region T/5 to 2T/5, then

Set D: =2,

Else

Go to next step.

STEP5. If the neighboring node lies in the region 2T/5 to 3T/5, then

Set D: =3,

Else

Go to next step.

STEP6. If the neighboring node lies in the region 3T/5 to 4T/5, then

Set D: =5,

Else

Go to next step.

STEP7. If the neighboring node lies in the region 4T/5 to T, then

Set D: =4,

Else

Exit.

4. RESULT AND ANALYSIS

4.1 Simulators Used*:*

Network Simulator-2 (NS-2) is a simulation environment for large wireless and wire line communication networks.Ns-2 appeared as a network simulator that provides a significant simulation of transport, routing and unicast over wired and wireless networks. Ns-2 code is written in C++ and OTCL and is kept in a separate file that is executed by OTCL interpreter, thus generating as output file for Network Animator (NAM). It then plots the nodes in position defined by the code script and exhibits the output of the nodes communicating with each other

VanetMobiSim- The Vehicular Ad Hoc Networks Mobility Simulator (VanetMobiSim) is a set of extensions to CanuMobiSim, a framework for user mobility modelling. The framework includes a number of mobility models, as well as parsers for geographic data sources in various formats, and a visualization module. The set of extensions provided by VanetMobiSim consists mainly on a vehicular spatial model using GDF-compliant data structures, and a set of vehicular-oriented mobility models.

4.2 Simulation Parameters:

The simulation of our thesis is performed using Network Simulator tool. A grid of size 1000m*1000m has been selected as the simulation area. In an effort to mirror real life on-road scenarios, simulations are carried out at varying vehicle densities. The number of vehicles is 50 in city and 30 in highway scenario. The vehicles move at randomly chosen speeds ranging from 18 to 90 km/h in city and 72 to 144 km/h in highway scenario i.e. in effect, vehicles have different accelerations at different time stamps. CBR traffic with a packet size of 512 bytes at the rate of 16Kbps is employed.

Table 1.1 Simulation Parameters

Scenario	City	Highway
Grid Size	1000m*1000m	1000m*1000m
No. of Vehicles	50	30
Velocity of Vehicles	18-90Km/h	72-144 Km/h
Transmission Range	250m	250m
Packet Size	512 Bytes	512 Bytes

4.3 Output Comparison Table:

In the comparison table, the proposed protocol MGROOV is compared with AODV and DSDV for the parameters such as Generated Packets, Received Packets, Packet Delivery Ratio, Total Dropped Packets and Average End-To-End Delay. Here is a brief description of all of them-

(i) Generated Packets- It is defined as the total number of packets generated by the source to transmit into the network.

(ii) Received Packets- It is defined as the total number of packets received by the destination that are generated by the source.

(iii) Packet Delivery Ratio- It is the total number of packets transmitted by the source to the total number of packets received by the destination. The basic idea for PDR to choose reliable routes. 100% delivery means receiver receive all packets sent by sender node before time period expires. It may be affected by different factors such as packet size, group size, range and mobility of nodes.

(iv) Total Drop Ratio- It is defined as the ratio of total number of packets dropped to the total number of packets transmitted within a particular time interval.

(v) Average End-to-End Delay- The average time taken by a data packet to reach the destination. It also includes the delay caused by route discovery process and the queue in data packet transmission. Only the data packets that successfully delivered to destination are counted.

As Shown in Table 1.2

5. CONCLUSION

We concluded that the efficiency of VANETS in terms of Packet Delivery Ratio and Average End-To-end Delay in fickle road environments with varying traffic densities and it has been proved that the proposed technique adapts itself to the varying densities and varying vehicle velocities and thus providing high packet delivery ratio and lower average end to end delay

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Table 1.2 Output Comparison

Protocols →	AODV		DSDV		MGROOV	
Scenario → Parameters ↓	CITY	HIGHWAY	CITY	HIGHWAY	CITY	HIGHWAY
Generated Packets	2919	4832	2160	5377	12244	6562
Received Packets	2739	4762	591	4479	12119	6431
PDR	93.8335	98.5513	27.3611	83.2992	98.9791	98.0037
Total Drop Ratio	173	58	4	43	98	64
Avg. End-to-End Delay(ms)	245.178	120.891	0	32.6774	77.3085	116.721