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Performance Improvement in VANET by Modifying AODV Routing Protocol

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Abstract:
A Vehicular Ad hoc network (VANET) is a type of peer-to-peer wireless network that allows providing communication between vehicles and nearby fixed roadside equipment. Vehicular ad hoc networks (VANETs) are classified as an application of Mobile Ad hoc Network (MANET) that has the potential in improving road safety and in providing travellers comfort. In VANET due to fast vehicle movements the link topology changes rapidly hence lifetime of connection is short, hence dissemination of data is challenging in VANET and basic routing protocols cannot work efficiently. In this paper we improve the performance of Vehicular Ad-hoc Network (VANET) by modifying Ad-hoc On-demand Distance Vector (AODV) routing protocol, we compare proposed Improved Ad-hoc On-demand Distance Vector (IAODV) routing protocol with basic AODV protocol in terms of network parameter Average End-to-End Delay.

***Keywords*-** AODV, Vehicular Ad hoc Network (VANET) , Improved AODV

1. Introduction

Vehicular Ad Hoc Network (VANET) is a new challenging network environment pursues the concept of ubiquitous computing for future. Vehicles equipped with wireless communication technologies and acting like computer nodes will be on the road soon and this will revolutionize the concept of travelling. VANETs bring lots of possibilities for new range of applications which will not only make the travel safer but fun as well. Reaching to a destination or getting help would be much easier. The concept of VANETs is quite simple by incorporating the wireless communication and data sharing capabilities, the vehicles can be turned into a network providing similar services like the ones with which we are used to in our offices or homes. For the wide spread and ubiquitous use of VANETs, a number of technical challenges exist.

VANETs are considered as an off-shoot of Mobile Ad hoc Networks (MANETs), however they have some distinguishing characteristics too. The solutions proposed for MANETs need to be evaluated carefully and then adapted in order to be used in VANET context. Besides, VANETs are also similar to MANETs in many ways. For example, both networks are multi-hop mobile networks having dynamic topology. There is no central entity, and nodes route data themselves across the network. Both MANETs and VANETs are rapidly deployable, without the need of an infrastructure. Although, MANET and VANET, both are mobile networks, however, the mobility pattern of VANET nodes is such that they move on specific paths (roads) and hence not in random direction. This gives VANETs some advantage over MANETs as the mobility pattern of VANET nodes is predictable. MANETs are often characterized by limited storage capacity and low battery and processing power. VANETs, on the other hand, do not have such limitations. Sufficient storage capacity and high processing power can be easily made available in vehicles. Moreover, vehicles also have enough battery power to support long range communication. Another difference is highly dynamic topology of VANETs as vehicles may move at high velocities. This makes the lifetime of communication links that comes into range of the neighbours are usually quite short.

2. Literature Survey

2.1 Theory of Background

Vehicular Ad hoc Network (VANET)

VANET or Intelligent Vehicular Ad-Hoc Networking provides an intelligent way of using vehicular Networking.

The main goal of VANET is providing safety and comfort for passengers. Each vehicle equipped with VANET device will be a node in the Ad-hoc network and can receive & relay other messages through the wireless network. Collision warning, Road signal arms and in place traffic view will give the driver essential tool to decide the best path along the way.

VANETs can be distinguished from other kinds of ad hoc networks as follows:

1. Highly Dynamic Topology
2. Frequently Disconnected Network:
3. Sufficient Energy And Storage:
4. Geographical Type of Communication:
5. Mobility Modelling and Predication:
6. Various Communications Environments:
7. Hard Delay Constraints:
8. Interaction With On-Board Sensors:

Ad hoc On-Demand Distance Vector (AODV)

AODV is a well known distance vector routing protocol and works as follows. Whenever a node wants to start communication with another node, it looks for an available path to the destination node, in its local routing table. If there is no path available, then it broadcasts a route request (RREQ) message to its neighborhood. Any node that receives this message looks for a path leading to the destination node. If there is no path then, it re-broadcasts the RREQ message and sets up a path leading to RREQ originating node. This helps in establishing the end to end path when the same node receives route reply (RREP) message. Every node follows this process until this RREQ message reaches to a node which has a valid path to the destination node or RREQ message reaches to the destination node itself. Either way the RREQ receiving node will send a RREP to the sender of RREQ message. In this way, the RREP message arrives at the source node, which originally issued RREQ message. At the end of this request-reply process a path between source and destination node is created and is available for further communication.

2.2 Directions from Previous Research Work

This section describes literature review or the studies that gives a direction in which research can be done.

PAPER 1:- Improved AODV Routing Protocol for Vehicular Ad hoc Networks[11]
AUTHORS:- Baozhu Li, Yue Liu and Guoxin Chu
SUMMARY:-
Improved protocol called AODV_BD is proposed.
Performance of AODV routing protocol is compared with the performance of AODV_BD routing protocol on the basis of network performance indicators Average End-to-End Delay.
Average End-to-End Delay: The margin between the time when data packets arrive at the application layer of the destination node and the time when the source node sends data packets.
The simulation results showed that the Average end to end delay of AODV protocol is larger than that of AODV _BD protocol.

PAPER 2:- Increasing Packet Delivery in Ad Hoc On-Demand Distance Vector (AODV) Routing [17]
AUTHORS:- Noor Azlan Ahmad, Shamala K. Subramaniam, Jalil Md. Desa

SUMMARY:-
Performance of existing Ad hoc-On demand distance vector routing protocol (AODV) is enhanced using Lifetime Ratio (LR) to discard unnecessary packets in the rebroadcast function of AODV.
Packet delivery ratio (PDR) is improved and proved using simulation results which are based on metrics of number of nodes vs packet delivery ratio and speed vs packet delivery ratio.

PAPER 3:- Simulation of An Improved AODV Algorithm for Ad Hoc Network [12]
AUTHORS:- Fei Jiang , JianJun Hao
SUMMARY:-
In this paper AODV protocol is optimized by improving and extending the hello mechanism in order to reduce the network overload and increase protocol efficiency. AODV_OA is new optimized protocol.

PAPER 4:- Multipath Contribution of Intermediate Nodes in AODV Extensions [16]
AUTHORS:-Abdulsalam Alammari, Ammar Zahary, Aladdin Ayesh
SUMMARY:-
This paper compares performance evaluation of three protocols
1. Traditional AODV
2. Multipath intermediate (MIAODV)
3. Non-multipath intermediate (NMIAODV)
Simulation results shows that multipath extension of AODV such as MIAODV and NMIAODV has better performance in terms of Packet Delivery Fraction (PDF), Average end-to-end Delay, Normalized routing load.

PAPER 5:- Mobility Models for Vehicular Ad-hoc Network Simulation [14]
AUTHORS:- Vaishali D. Khairnar , Dr. S.N.Pradhan
SUMMARY:-
In this paper authors had implemented and executed MOVE tool, which provide facility for the users to generate real world mobility models for VANET simulation.

3. Proposed Work

3.1 Overview of Proposed Work

We are going to try to improve the performance of VANET by modifying AODV routing protocol by integrating routing mechanism of Dynamic Source Routing (DSR) and Ad-hoc On-demand multipath routing protocol (AOMDV) protocols with AODV in terms of network performance indicator named Average End-to-End Delay.

3.2 The algorithm for proposed method

Route Request Procedure

```
Route Request Packet is received by node i
If node i is destination node then
   Route Request Packet is replied by node i
Else
     If node i is second node then
          Create link from node i to source node
          Rebroadcast the packet after appending node ID and sequence number of second
            node
      Else
        If route exists in the table then
```



```
            If check for better route exists then
              Update existing route
              End if
              Discard Packet
          Else
              Create a reverse link for source node in routing table
                Create a reverse link for second node in routing table
                Rebroadcast the packet
            End If
        End If
    End If
```

Route Reply Procedure

```
Route Reply Packet is received by node i
If node i is the source node then
   If alternative route exits then
      If check for better route exists then
         Update existing route
      End If
   Else
      If primary route exists then
          If check for better route then
            Add route as secondary path
          Else
            Add route as primary route
      End If
    End If
 End If
   Discard Route Reply Packet
Else
   If there exists primary route then
      If check for better route then
        Update existing route
        Forward Route Reply Packet
      Else
        Discard Route Reply Packet
      End If
   Else
         Add the route as primary route
         Forward Route Reply Packet
      End If
End If
```

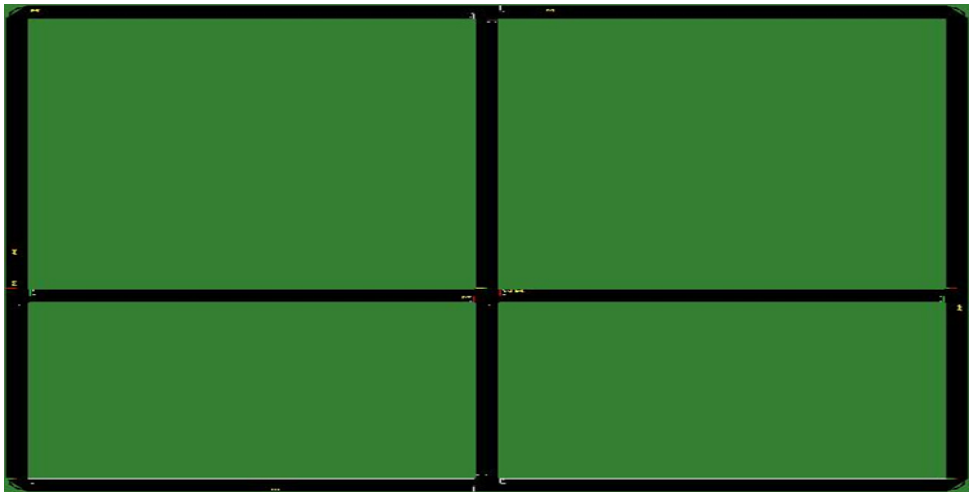
4. SIMULATION ENVIRONMENT

In this proposed work we had used network simulation tool, NS2. 35 [4] as a simulation platform.Mobility of vehicle is generated with tool named Mobility Models for Vehicular Ad-hoc Network (MOVE) [5] which work on Simulation of Urban Mobility (SUMO) [6], which is open source software.We had modified existing basic AODV routing protocol and created a new routing protocol named Improved Ad hoc On-Demand Distance Vector (IAODV) routing protocol and integrated it with NS-2.35.'

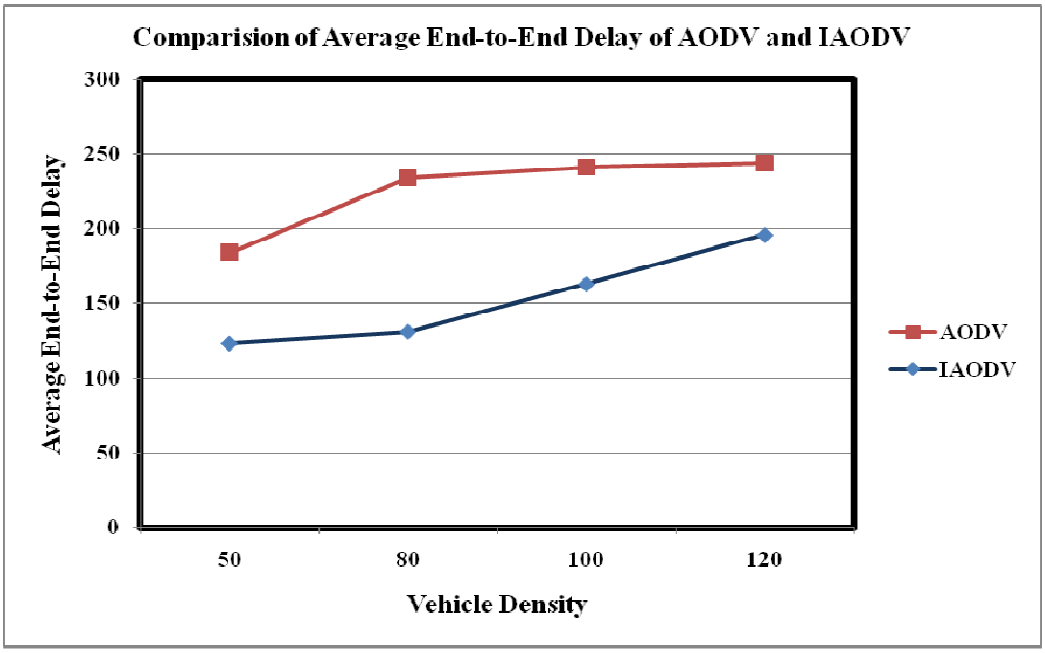
Parameter	Value
Simulation time	500 Second
Simulator	NS 2.35
Anteena model	Omni directional antenna
Radio Propagation Model	Two Ray Ground
Interface Queue Type	Priority Queue
MAC Type	IEEE 802.11
Routing Protocols	AODV, IAODV
Simulation Area	652 m * 552 m
Number of vehicles	50,80,100,120
Mobility of Vehicles	40 km/hr

TABLE 1 SIMULATION PARAMETERS

ROAD TOPOLOGY



5. RESULT OF PROPOSED WORK



6. CONCLUSION

Results of proposed work concludes that creating a secondary path or backup path and by limited source routing between source and destination node reduces Average End-to-End delay as compared to basic AODV routing approach in Vehicular Ad hoc Network (VANET).

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