AODV ROUTING PROTOCOL FOR IMPROVING EFFICIENCY IN VANET
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ABSTRACT:

VANET (Vehicular Ad-Hoc Network) is a technology that uses mobile cars as a node in a network to create a mobile network. VANET facilitates every participating car into wireless router or node, allowing cars approximately 100 to 300 meters of each other to connect and in turns create a network with a wide range. Due to high mobility, VANET has more problems than MANET (Mobile Ad-Hoc Network). Thereby, in this paper we propose a modification on AODV as MANET routing protocol to make it adaptive for VANET and augmenting to minimize the energy consumption with improved efficiency. For mobile nodes mobility can be in terms of position, direction and speed. In proposed methodology, we have used direction as most important parameter to select next hop during a route discovery phase in location based clustering approach. A novel location based routing solution over VANETs to form a cluster in terms of lanes that is able to address vehicle preferences and deliver content. We will improve the energy consumption by placing base station among two clusters.

Keywords: VANET, AODV, Modification on Routing Protocol, Energy, Efficient

[1] INTRODUCTION

Vehicular Ad-Hoc Network (VANET) develops a vehicular communication system to enable quick and energy efficient distribution of data for the benefit of passenger’s safety and comfort. Vehicular Ad-Hoc Networks (VANETs) are special type of Mobile ad Hoc Networks (MANETs), where wireless-equipped vehicles form a network spontaneously while traveling along the road. Direct wireless transmission from vehicle to vehicle make it possible to communicate even where there is no telecommunication infrastructure such as the base stations of cellular phone systems or the access points of wireless dedicated access networks, needed in the previous Intelligent Transportation Systems (ITS).

VANETs define two modes of communication, Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I). Many traditional wireless networks, vehicles are often moving very quickly, and may only remain in an AP radio coverage area for a relatively short period of time. Since multiple vehicles may be present in the AP coverage area, the question arises as to the order with which vehicles should be served. Energy efficient road-side access point scheduling is considered. A scheduler is designed that is capable of satisfying the communication requirements of the vehicles in the vicinity of the AP while minimizing the energy needed using
AP power control. A novel user-oriented cluster-based solution for multimedia delivery over VANETs that is able to personalize multimedia content and its delivery based on the preferences of the passengers and their profiles. Two techniques are used: cluster formation and cluster head selection. The cluster formation algorithm aims to group vehicles based on vehicle characteristics and user interest in content. The cluster head selection algorithm makes sure that cluster head function is efficiently distributed among vehicles.

As a routing protocol for mobile ad hoc networks, AODV is intended to accommodate networks that are as large as several thousand nodes. It is one of several demand-driven (or on-demand) protocols that are in existence today. Hence, the protocol is invoked only when a node (host) has data to transmit. It is a reactive protocol. The AODV RFC indicates that the transport layer protocol is UDP, which of course only offers best effort delivery of packets, and does not support either error recovery or flow control. Addressing is handled using IP addressing since each node acts as both a host and routing node, each must maintain a routing table that contains information about known destination nodes. Entries are keyed to destinations.

There are many routing protocols for ad hoc networks. One of the most important of them is AODV. AODV is an on-demand routing protocol. This protocol finds routes for a node only when it has data packet for transmission.

**About AODV Routing Protocol**

AODV is an on-demand routing protocol. There are two phases: Route Discovery and Route Maintenance. Each node maintains a routing table with knowledge about the network. AODV deals with route table management. Route information maintained even for short-lived routes – reverse pointers. This protocol uses following Messages for transmission:

**RREQ Messages**

While communication routes between nodes are valid, AODV does not play any role. A RREQ message is broadcasted when a node needs to discover a route to a destination. As a RREQ propagates through the network, intermediate nodes use it to update their routing tables (in the direction of the source node). The RREQ also contains the most recent sequence number for the destination. A valid destination route must have a sequence number at least as great as that contained in the RREQ.

**RREP Messages**

When a RREQ reaches a destination node, the destination route is made available by uncasting a RREP back to the source route. A node generates a RREP if it is itself the destination. It has an active route to the destination. Ex: An intermediate node may also respond with an RREP if it has a “fresh enough” route to the destination. As the RREP propagates back to the source node, intermediate nodes update their routing tables (in the direction of the destination node).

**RERR Messages**

This message is broadcast for broken links. Generated directly by a node or passed on when received from another node.

**Advantages of AODV**

One method that AODV handles congestion is, if the source node receives no RREP from the destination, it may broadcast another RREQ, up to a maximum of RREQ_RETRIES. For each
additional attempt that a source node tried to broadcast RREQ, the waiting time for the RREP is multiplied by 2. We can find more than one route for any pair of source and destination.

**Objective**

Our objective in proposed technique is to perform Modification on AODV to make it adaptive for VANET, for conserving energy while transmitting data among nodes and enhancing AODV protocol that improves route discovery phase by incorporating the route discovery techniques.

**PROBLEM DEFINITION**

The Existing system are working on the mobility parameter such as speed, direction, position which consume more energy during data transmission so in the proposed system we are using the parameter as distance between node in a cluster and base station and try to minimize the energy consumption during data transmission and improving energy efficiency in VANET using two tier data delivery mechanism.

[2] **LITERATURE SURVEY**

In “Enhancing AODV Routing Protocol Using Mobility Parameters” Abedi et.al [1] stated that Direction and Position are most commonly used mobility parameter where Next Hop selection is preferred. When a source node wants to send a packet to destination node, Routing protocol gets direction of source node and destination node recognize intermediate node that can be participate in route between source and destination. Using Manhattan mobility model, nodes can move in three situations: either in same direction, opposite direction or orthogonal.

In “Ad hoc Wireless Multicast with Mobility Prediction”, By S. Lee et al.[3] A method that can be used for stable routing is mobility prediction. In that, by using mobility parameters such as node’s speed and node’s position, node’s movement can predict. Therefore, we can select routes that are more stable than other route.

In “Securing Ad-hoc Routing Protocols”, According to M. Zapata et al. [2] many improvements are made on this protocol. He proposed a new version of AODV (SAODV) that improves AODV security. The SAODV routing is used to protect the routing messages of the original AODV. SAODV uses digital signatures to authenticate non-mutable fields and hash chains to authenticate the hop-count field in both RREQ and RREP messages.

Considering energy efficient road-side access point Scheduling we propose a scheduler that is capable of satisfying the communication requirements of the vehicles in the vicinity of the AP while minimizing the energy needed using AP power control. Abdulla et al. [5]. A novel user-oriented cluster-based multimedia delivery solution over VANETs that is able to address vehicle passenger preferences and deliver multimedia content of their interest based on clustering approach is described in [6]. As per the above reference they conclude that AODV is one of the best ad hoc routing protocols with overall better performance in terms of three metrics: delivery ratio, routing overhead and path optimality. Hence we propose AODV is a good routing protocol for scenarios with high mobility using clustering technique and also conserve energy during transmission.

[3] **RESEARCH METHODOLOGY**

**Existing System Methodology**

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Manhattan mobility model was considered which the most important mobility models are for VANET. In Manhattan mobility model, several horizontal and vertical streets co-exist in the simulation field and mobile nodes are moving on the lanes (in both directions) of the streets. Vertical and horizontal streets may cross with each other at the intersection. In this mobility model, acceleration is an input parameter. To calculate node’s next speed, model uses acceleration and current speed of node. If one direction of a lane has positive value 1, then the lane on the opposite direction must have the negative value -1. Streets of each map have the maximum and minimum allowed velocity (Vmin, Vmax).

Mobility Parameter were Direction and Position. For identifying the route from source to destination the Next Hop selection techniques is used in which Direction is most important as compared to Position. When a source node wants to send a packet to destination node, Routing protocol gets direction of source node and destination node and Recognize intermediate node that can be participate in route between source and destination. Condition for Next Hop selection Algorithm is that a node can be select as next hop in route between source and destination that has two conditions either It moves in same direction with source and/or destination or else Intermediate node’s location is between source and destination.

**Next Hop selection Algorithm** can be summarized in following stages:

- **Input:** Source node, destination node and candidate node for next hop.
- **Determines:** Whether a candidate node can be an intermediate in route between source and destination.
- **Functions:** Get_Direction function returns direction of input node and Get_Position function returns location of any input nodes in network.
- **Limitation:** May be we cannot find any intermediate node as next hop for routes
- **Overcome:** Put lower bound on no of discovered routes, then the protocol searches for nodes that have both condition of position and direction. If results satisfy lower bound of routes searching is finished otherwise removes position condition and all nodes that are in same direction with source and/or destination, can be selected as intermediate nodes for route.

**Pseudo Code : Next Hop selection**
Next_Hop (node, source, destination)
// Step1:
{
    Ds = Get_Direction(source);
    Dd = Get_Direction(destination);
    Dn = Get_Direction(node);
    If ((Dn == Ds) || (Dn == Dd))
    //Step 2:
    {
        Ps = Get_Position(source);
        Pd = Get_Position(destination);
        Pn = Get_Position(node);
        If ((Ps<=Pn<=Pd) || (Pd<=Pn<=Ps))
            Return TRUE;
        Else Return FALSE;
    }
    Else Return FALSE;
}

Proposed System Methodology

In Proposed Methodology we are working in following stages:
- Network Formation
- Cluster Formation
- Data Transmission mode
- Energy consumption Calculation

We are incorporating Location based clustering mechanism that is able to address vehicle passenger preferences and deliver content of their interest. The client server architecture includes, A server in the back-end which stores the content and is able to retrieve the content based on preference and location information, A Roadside units (RSU) which is a mediator for communication among Server and client and The vehicles as clients (nodes) Whenever a node decides to send a data packet the most important parameter under consideration is distance between the source node and destination node and energy consumed during transmission. In VANET, communication is of two types (V2V communication) Intra communication and (V2I communication) Inter communication.

![Figure: 2. Communication modes in VANET](image)

Designing of Network

Options of Network (eg. Nodes, routing protocols, start time and stop time of a network, life time of a network), Formations of node (with respective to X and Y axis), Operations on node (algorithm implementation, deciding to whom the packet should be delivered), Establishing the
communication, Transmission of data packet, Analysis the transmission on different parameter (time required, delay, noise) by graph plotting commands, Stopping the communication.

**Functions:**

Distance (S-R), Distance (S-RSU-R), Energy (S-R), Energy (S-RSU-R)

Whenever a data packet is originated in a network between any source and destinations following functions are calculated. Depending on the calculated value it is decided whether to opt a direct path between source and destination or to have RSU as an intermediate node between source and destination.

![Figure: 3. Communication Via Channel](image)

**In Proposed LBC – VANET Algorithm**

Whenever a node decides to send a data packet the most important parameter under consideration is distance between the source node and destination node and energy consumed during transmission consider the following parameters:

- Let the distance between source node and destination node be \( d \).
- Energy required for transmission of data packet from source node be \( T_r \).
- Energy required for reception of data packet from receiver node be \( R_r \).
- Energy required for receiving acknowledgement of data packet be \( R_{ac} \).
- Energy required by RSU for finding route from routing table be \( R_{rt} \).
- Routing power be \( P_r \).

**Pseudo Code:**

Distance (source node and destination node )
Energy required ( \( T_r, R_r, R_{ac}, R_{rt} \) )
Routing power( \( P_r \) )
Functions
Distance (S-R)
Distance (S-RSU-R)
Energy (S-R)
Energy (S-RSU-R)
Step 1
Calculate Distance (S-R) between Node A and B.
Step 2
Calculate Distance (S-RSU-R) between Node A, B and RSU.
If Distance (S-R) \( < \) Distance (S-RSU-R)
If Energy (S-R) \( < \) Energy (S-RSU-R)
Then select Distance (S-R)
Else select Distance (S-RSU-R)
[3] SIMULATION RESULTS

Comparing data packet delivery with LB-VANET algorithm and without LB-VANET algorithm considering different simulation parameters like energy, delay, throughput, jitter. The simulation experiments were conducted on NS2.34 [7] and IEEE 802.11 with a transmission rate of 2Mbps and a transmission range of 250m was used as the underlying MAC protocol. We used VanetMobiSim [8] to generate a 4 x 4 flat grid topology of a 1600m by 1600m area. All streets have two lanes and are bi-directional. Road side unit is placed in between the lanes for communication via channel. In each simulation run, we randomly selected two to three data packet delivery, using 512-byte constant bit rate (CBR), an UDP-based packet generation application. In the simulations, the number of vehicles considered is 20 to 40. The running time of each run is 500 to 1000 seconds. All simulation results are an average over 10 runs. Table 1 summarizes the parameters used in the simulations.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network simulator</td>
<td>NS2</td>
</tr>
<tr>
<td>Mobility simulator</td>
<td>VanetMobiSim</td>
</tr>
<tr>
<td>Simulation area</td>
<td>1600m x 1600m</td>
</tr>
<tr>
<td>Simulation runs</td>
<td>3-4</td>
</tr>
<tr>
<td>CBR rate</td>
<td>512bytes/second</td>
</tr>
<tr>
<td>802.11 rate</td>
<td>2Mbps</td>
</tr>
<tr>
<td>Average vehicle speed</td>
<td>50km/hr</td>
</tr>
<tr>
<td>Transmission range</td>
<td>250m</td>
</tr>
<tr>
<td>Simulation time</td>
<td>500 to 1000 sec</td>
</tr>
<tr>
<td>Number of vehicles</td>
<td>20 to 40</td>
</tr>
</tbody>
</table>

Table 1 Simulation Parameters

The average packet delay and the packet delivery ratio with the LB-VANET algorithm and without algorithm, respectively, under different simulation runs is shown below. It is seen that the packet delivery ratio with applied algorithm is more as compared to data delivery with different cluster based algorithm. It is seen that the packet delivery ratio increases with the node density increasing. The LB-VANET algorithm can significantly improve the packet delivery ratio as compared with other algorithm. The below figure shows the simulation results for energy, delay, throughput, jitter.
Energy graph shows the comparison of energy consumed, concludes that energy consumption was lesser in data delivery with algorithm as compared to without algorithm hence resulting in a more efficient technique for data transmission.

The variation in the time between packets arriving caused by network congestion, time drift or route change can be expressed in terms of Jitter. A simulation result for jitter parameter is shown below indicating the comparative results for two different modes of communication.

[4] CONCLUSION

We proposed an enhanced AODV protocol that will improves the performance issues on common AODV protocol using location based mechanism so as to improve the route discovery phase and will also contribute to minimize the energy consumption required during the data transmission phase by incorporating two tier mechanisms. The proposed system will enhance protocol to work well in various traffic situations, the overhead of each route in AODV will be less, Energy is conserved as we are using two tier data delivery mechanism. In future
scope we can incorporate more no of road side units and increase the number of lanes so as to provide wider scope and efficiency for communication over a wide range of area.

REFERENCES