Plummeting Data Loss for Multihop Wireless Broadcast using Position Based Routing in VANET

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Abstract—Multihop Wireless Broadcast is an important factor in VANET. Broadcasting is the most common operation which is used by many applications. But efficiency in routing is difficult to achieve. Many other protocols consider the performance degradation based on the factors like Node density, spatial distribution pattern and channel quality. Distribution Adaptive Distance with Channel Quality (DADCQ) protocol overcomes these factors considering all the three factors. The protocol utilizes the distance method to select forwarding nodes and also the results to achieve high reachability and low bandwidth consumption in urban and highway scenarios. But there is no guaranteed packet transmission and selecting threshold value by considering all the difficult factors. This can be achieved by using Position Based Routing Protocol by put into action of GPRS Algorithm. The PBR protocol makes use of location information and suited for distributed, centralized and decentralized systems. Thus the proposed system will considerably reduce packet loss and to improve throughput.

Keywords— Channel quality, Distribution Adaptive Distance with Channel Quality, Multihop Wireless Broadcast, Node density, Spatial distribution pattern.

I. INTRODUCTION

VANET has become an active area of research and development. Because it has great potential to improve vehicle and road safety. It also provides convenience to both drivers and passengers. Recent research efforts have placed by giving more importance on VANET architectures and implementations. VANET differs from MANET because in VANET the nodes strictly follow the traffic rules and their pattern of movement is very complex [5]. To improve the results VANET simulation, it is important to generate a realistic mobility model. Multihop wireless broadcast is an important operation of wireless systems.

Most of the ad hoc networking protocols use broadcast to discover routes. It is demonstrated that blindly retransmitting broadcast packets (flooding) can lead to an explosive growth of traffic called the broadcast storm problem [10], [7], that attenuates broadcast performance as a result of collisions and congestion. The major problem of Broadcasting, is each node must know its own position and the neighbour's position. But in VANET, there is no fixed topology and also movement of vehicles (node) will be of high speed[15].

So, the node position will vary at high speed. Due to this problem there is high risk of data loss which will reduce the system throughput and efficiency. To overcome this problem Position Based Routing Protocol is modified with suitable technique and that will improve the throughput by reducing packet loss. The related work deals with literature survey that evaluates the message delivery rate and packet loss ratio of various protocols.

After evaluating the performance, Distribution Adaptive Distance with Channel Quality is selected. But it has many drawbacks. To overcome the short coming Position Based Routing Protocol with suitable technique is selected. And hence to reduce the packet loss further, the protocol is modified. The next section deals with System Design. After implementation, the result compares the performance of two different protocols namely, Distribution Adaptive Distance with Channel Quality and Position Based Routing Protocol. The final section deals with conclusion and future works.

II. RELATED WORK

Multihop broadcast in VANET mainly concentrate on two types. The application are:

- Safety Application
- Broadcast Application.

First one type is safety applications such as Collective Collision Avoidance (CCA) where on the event of an emergency an alert message is propagated as quickly as possible. The focus of this work is the second type of VANET broadcast application such as traffic data dissemination.

These applications require data to be distributed to a large area as economically as possible, with less stringent dependability and delay requirements than CCA-type applications.

Several protocols have been built using these methods that are adaptive to node density. Many papers have addressed

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the need to make stochastic broadcast adaptive to density [2], [4], [12].

Direction aware Broadcast Forwarding [9] minimizes the number of vehicles involved in the platoon chain collisions and Limit vehicle collisions in the presence of radio channel errors. But packet loss occurs through errors.

In designing, Distributed Vehicular BroadCAST (DV-CAST) Protocol assumes that the infrastructure is not available in the network considered [6],[13]. This is a reasonable assumption, that it would take years to utilize such infrastructures as automotive and telecommunication industries have to cooperate.

To enable communication in VANET, assume that each vehicle has a Global Positioning System (GPS) and a wireless communication device, periodically sends out beacon messages (hello messages) to its neighbors at a default frequency of 1 Hz. Finally, assume that not every vehicle is a member of a specific VANET due to the market penetration factor.

It is suited for sparse, regular and dense traffic. But assumes connectivity wont fail and completely Relay only on GPS. If GPS fails then the local information becomes unavailable[14]. Global topology information may be collected and disseminated by the existing infrastructure but never used. The most important parameters for DV-CAST protocol are the local topology information and the Region of Interest. The protocol works well based on the following three situation. They are as follows:

- Verify whether the receiver of the message that is moving in the same direction as the source.
- Verify whether the vehicle is the last vehicle in the cluster.
- Verify whether it is connected to at least one vehicle in the direction opposite to the direction of the moving vehicle.

Satisfying all these condition is difficult and also it is not suited well to urban environments. So, a new protocol namely Urban Vehicular BroadCAST (UV-CAST) is designed [11].

UV-CAST, for urban VANETs which assume zero infrastructure support. UV-CAST is a completely distributed broadcast protocol and it can be implemented by using only the local information available to each vehicle in an urban VANET. This protocol is suited for distributed environment and operates independently based on the local information. The overall performance of UV-CAST is good. But connectivity problem degrades the performance.

III. DISTRIBUTED ADAPTIVE DISTANCE WITH CHANNEL QUALITY (DADCQ) PROTOCOL

In the Existing system, DADCQ [3] protocol is used for multi hop broadcasting in Vehicular Ad hoc Network. VANET's demonstrate wide variation in node density, pattern distributed, and quality of the channel. In reaction, the protocol should be designed by utilizing the distance heuristic that is adaptive to all these factors. The distance method has been made adaptive to a range of node density, but not competent across a range of these three factors concurrently. Fulfilling the entire three factors is very difficult which results in performance degradation. To overcome the problem Position Based Routing Protocol is used.

IV. POSITION BASED ROUTING PROTOCOL

Topology change is more common in case of vehicular ad-hoc networks, which makes routing as a challenging task. Position-based routing algorithms require information about the physical position of the nodes in the network. Each node determines its own position through the use of GPS or by using some other type of positioning service. The performance depends on forwarding strategy used to forward the packets. A forwarding strategy can be any one of these strategy:

- Greedy forwarding,
- Restricted directional flooding and
- Hierarchical routing.

Greedy forwarding is used when there is a path between source and destination. There is no need of route establishment or maintenance and also there is no guarantee for a packet to reaches its destination [8].

Metrics can be hop count, distance, progress to destination, direction, power, cost, delay. If the packet has reached a node which has no neighbours to the destination, a recovery procedure through flooding or any other method is necessary.

Flooding is the forwarding strategy in which every packet is sent from the source until the destination is reached. Restricted directional flooding implies the packet is sent to all single hop neighbours in the path towards the destination. The neighbours who receive the packet check whether they suit the criteria to forward the packet or to drop it. Multiple copies of the same original packet are in the network at a certain moment in time.

Hierarchic forwarding combines forwarding strategies according to network structures. Some may use zone based routing and some may combine geographic routing with forwarding packets based on greedy strategies [1]. There are many problems such as edge problem, location inaccuracy with the existing Greedy Perimeter Stateless Routing (GPSR) protocol. This is the commonly used Position Based Routing Protocol. In the edge problem, an edge which is repeatedly calculated twice drops the packet. Therefore the protocol fails to deliver the packet even though the routes exist.

In case of location inaccuracy problem, the graph is disconnected due to inaccurate location information. Position based routing (GPSR) work efficiently in the absence of location error. Due to error, Disconnection and Permanent loop may occur. Density plays a major role in this problem. The protocol suits better for high dense region because even the

location of the node is inaccurate. The location information of adjacent node can be used to find the node's current position. But in case of sparse traffic condition, an additional criteria is included by modifying the algorithm. The criteria which includes Packet drop, occurs only if the node has no connection with other node and at the same time it should not be the destination. Packet drop should be avoided in case of connection to the edge. In the previous protocol packet drop occurs just because of connection with the edge. So, two or more time the same message is dropped without passing the edge and affects the performance to a greater extent.

A. System Design and Description:

The architecture design of the current system is described below:

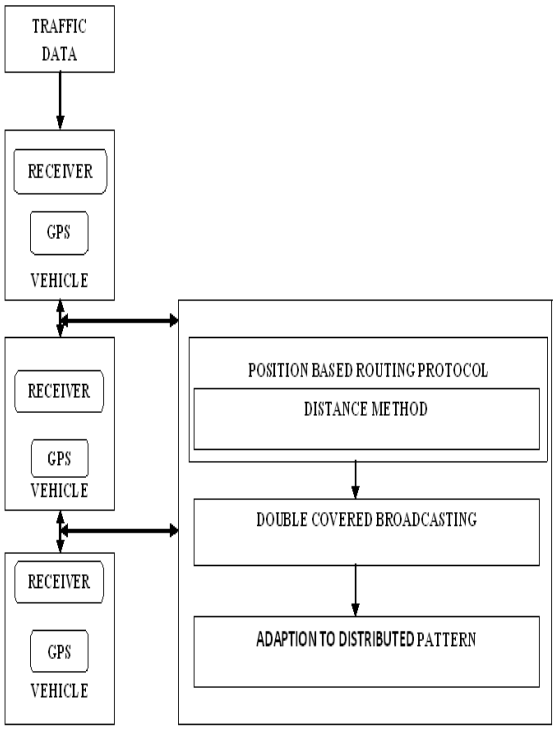


Fig. 1. Proposed PBR System Architecture

The information related to traffic such as jam or collision will act as input to the system. This input message should be passed to all other nodes lies inside the coverage region. The vehicles act as source, destination and Intermediate nodes. Before the message gets transferred from one node to another, the following steps are accomplished. They are:

- Steps are performed to design and implement a protocol.
- Global Positioning System (GPS) is attached with each vehicle. This shows the exact location of each vehicle.
- Distance method is used to find out the shortest distance between any two vehicles and thereby used to find out the nearby vehicles.
- If the distance between source node and destination node is high then the message should be rebroadcasted by the intermediate nodes until destination is reached.
- This will reduce the packet loss and the reachability of the message will be increased.

V. IMPLEMENTATION AND SIMULATED RESULTS POSITION BASED ROUTING PROTOCOL

A. Network Formation:

The roadmap, serves as an important influence in the effectiveness of the process. Therefore, the roadmap will have direct impact over the performance of dissemination process in VANET's. A highway topology is represented by a graph where vertices represent junction and edges represent road elements. The efficiency can be improved by selecting different roadmaps from real cities using Open Street Map and representing environments with different street densities.

B. Nodes Initialization:

In VANET Nodes the vehicles that are spread through the network communicates with one another. Each node is limited by its transmission range. Transmission range defines the distance within which two nodes can communicate directly, which limits its capacity to communicate with all the remaining nodes directly. Hence the destination node will be away from the source node therefore source node should be used with one or more intermediate nodes to reach the destination.

Vehicles will be equipped with sensors and communication devices that will allow the vehicles to communicate with each other.

C. Double Covered Broadcasting:

It is used in broadcast redundancy to improve the delivery ratio in the network environment. Among 1-hop neighbour, only selected nodes will retransmit the message. Forward nodes are selected based on any one of the following criteria [3]:

- The sender's 2-hop neighbours are covered
- The sender's 1-hop neighbours are covered by at least minimum of two forwarding neighbours. The non forwarding 1-hop neighbours of the sender do not acknowledge the reception of the message. If the sender does not detect all its forward nodes' retransmissions, it will resend the packet. The broadcasting algorithms help to minimize the overhead by reducing the occurrence of broadcast storms.

D. Adaptation to Distribution Pattern:

Quadrant method [3] is used to find out the pattern of node distribution. The quadrant method attempts to measure how evenly set of points are spaced. A point distribution can either be regularly spaced or randomly spaced. The quadrant method addresses the problem by investigating the frequency pattern. There are two basic quadrant methods: Quadrant censuring and Quadrant sampling. Censuring divides the space equally and counts the number of points. In sampling, a cell is placed at a random and the nodes are counted in number of times.

E. Performance Evaluation:

Position Based Routing Protocol comparatively better reachability and efficient use of bandwidth in both urban and highway scenarios with varying node density and fading intensity. The constraint to our proposed system is to reduce the reachability by considering node density. The simulation results show that proposed system performs better than previously used methods. Position Based Protocol has proved that extremely effective when the density of vehicles is high or low. The proposed method also performs well in all the scenarios like urban and highway.

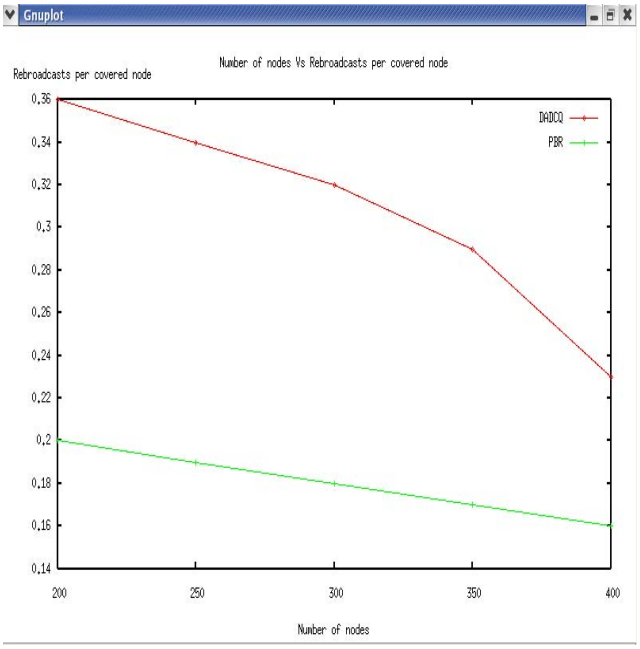


Fig. 2. Rebroadcast per covered node

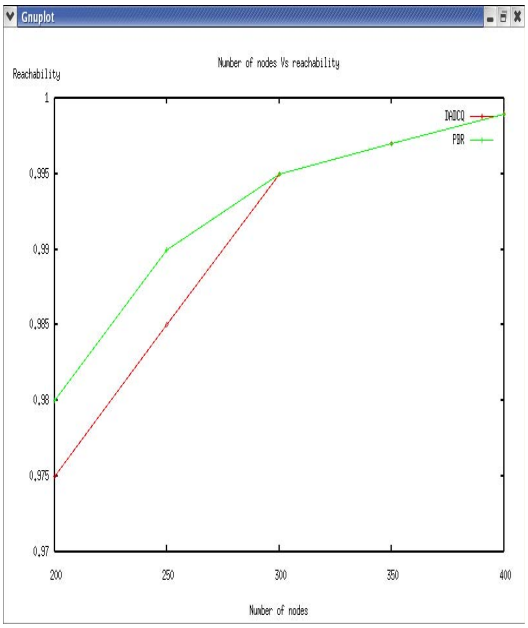


Fig. 3. Reachability with number of node

VI. CONCLUSION AND FUTURE WORK

The PBR protocol has been proposed for multihop broadcasting in VANET. VANET exhibits wide variability in topology without any prior notice. The main aim of the protocol is to reduce Packet loss and thereby improves the throughput. This can be done by two steps. The first is discovering position of the node. The next is selecting suitable forwarding technique. Each node determines its own position through the use of GPS or some other type of positioning service. The real success lies in selecting suitable forwarding technique. Among various techniques, Restricted Directional Flooding is selected as forwarding technique. Position-based routing does not require the establishment or maintenance of routes. The nodes neither have to maintain routing tables nor to update it. Thus maintenance and implementation of this protocol does not require any prior knowledge and overall performance is shown to be highly adaptable and efficient. In the Future, more importance can be given to the Localization problem.

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