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Efficient Flooding using Zonal Concept of LAR Protocol on AODV in MANETs

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***Abstract*— In MANETs, there is a constraint on network bandwidth, so different routing protocols has been proposed which broadcasts the packets by flooding which is simple but causes high retransmissions which lead to media congestion and packet collisions that can significantly degrade the network performance and throughput. So, we proposed flooding algorithm which makes use of the nodes position to rebroadcast the packets by using the zonal concept of LAR to limit the route of area discovery and efficiently spread the control traffic in the mobile ad hoc network, thus causing the enhancement of the protocol performance. The algorithm is applied on the Ad-hoc On Demand Distance Vector (AODV) routing protocol for the route discovery process to reduce the number of Route Request (RREQ) messages propagating through the network. This scheme improves the network throughput and reduces routing overhead.**

***Keywords*— AODV, Hello Messaging, Network Overhead, Routing.**

I. Introduction

Mobile Ad hoc Networking (MANET) is a group of independent network mobile devices that are connected over various wireless links. It is relatively working on a constrained bandwidth. The network topologies are dynamic and may vary from time to time. Each device must act as a router for transferring any traffic among each other. This network can operate by itself or incorporate into local area network (LAN). The special features of Mobile Ad Hoc Network (MANET) bring this technology great opportunity together with severe challenges. All the nodes are responsible to organize themselves dynamically to provide the communication between each other and the necessary network functionality in the absence of fixed infrastructure or we can call it ventral administration. It implies that the maintenance, routing and management, etc. have to be done between all the nodes.

There are two types of MANET; it includes Vehicular Ad hoc Networks (VANETs), Intelligent Vehicular Ad hoc Networks (InVANETs). The set of application for MANETs can be ranged from small, static networks that are limited by power sources, to large-scale, mobile, highly dynamic networks.

II. Literature Survey

Yu-Chee Tseng et al [1] identified an important issue in a MANET, the broadcast storm problem, which was demonstrated through analyses and simulations, how serious this problem could be. Several schemes, namely probabilistic, counter-based, distance-based, location-based, and cluster-based schemes, have been proposed to alleviate this problem. Simulation results based on different threshold values are presented to verify and compare the effectiveness of these schemes.

Prof. Abhishek Mathur et al.[2] proposed to improve the flooding process for MANET using NNRR protocol. This protocol selects four neighbours as nominated to rebroadcast the RREQ in case there aren't available route on those nodes rather than all the neighbours rebroadcast the RREQ and use the concept of Expected and Requested zone of LAR routing, which maintained the level of connectively among the network and at the same time reduce the overhead.

D. G. Reina et al [3] proposed broadcast scheme in which a hybrid flooding scheme has been proposed in order to combine the best of probabilistic, neighbour knowledge and area based flooding schemes. The result is a broadcast scheme which adapts its probability to the conditions of the network. In addition it also reduces the overhead caused due to broadcasting.

Aarti et al [4] discussed characteristics of MANETS, its challenges, advantages, application, security goals, various types of security attacks in its routing protocols were discussed. Different security mechanisms are introduced in order to prevent such network.

Robinpreet Kaur et al [5] made an effort on the comparative study of Reactive, Proactive and Hybrid routing protocols. A comparison of three protocols has been presented in the form of table, which includes various advantages and disadvantages, various shortcomings in different routing protocols and it is difficult to choose routing protocol for different situations as there is trade- off between various protocols.

Mohammad Ayash et al [6] presented two enhancement protocols to reduce the overhead of AODV. The proposed protocols use location information obtained by GPS to reduce the routing overhead of AODV. The first protocol (AODV-LAR) is a variation of the LAR protocol that limits the route discovery area to a small area of the network by using TTL estimation equation to reduce the time delay and control overhead. The second protocol (AODV-Line) uses node location information to restrict route search area to be only near the line connecting source and destination nodes. The simulation results show that AODV-LAR and AODV-Line outperform AODV where both protocols reduced the control overhead and the delay of AODV.

Sidi-Mohammed Senouci et al [7] described how the basic LAR may be optimized to improve its performance. The proposed algorithms limit the request zone which results in reducing the route request overhead. Simulation results indicate that we can reduce the routing overhead using alternative definition of request zone as compared to LAR algorithm especially for dense and highly dynamic ad hoc networks. Dipankar Deb [8] presented an algorithm which is location aided and also energy efficient. This approach is applicable in GPS scarce network. The major contribution of the work is in proposing a new location aided routing methodology that is energy efficient too. The location information helps keeping the number of control message exchanges low during the route discovery process. This is useful for better utilization of bandwidth.

K. Young-Bae et al [9] described how location information may be used to reduce the routing overhead in ad hoc networks. It presents two location-aided routing (LAR) protocols. These protocols limit the search for a route to the so-called request zone, determined based on the expected location of the destination node at the time of route discovery. Simulation results indicate that using location information results in significantly lower routing overhead, as compared to an algorithm that does not use location information.

Mohammad A. Mikki [10] proposed an Energy Efficient Location Aided Routing Protocol (EELAR) that is an optimization to the Location Aided Routing (LAR). EELAR makes significant reduction in the energy consumption of the mobile nodes batteries through limiting the area of discovering a new route to a smaller zone. Thus, control packet's overhead is significantly reduced and the mobile nodes life time is increased. The proposed EELAR protocol led to an improvement in control overhead and delivery ratio compared to AODV, LAR, and DSR protocols.

III. PROBLEM DESCRIPTION

The aim of this work is to design an efficient flooding algorithm for mobile ad hoc network using concept of LAR protocol to improve the network performance by restricting the area of route discovery. This can be achieved by involving a specific set of nodes in the dissemination process of the RREQ and use zonal concept. Having the information about location of each node and dividing the network area into multiple zones, we can reduce the RREQ packets to large extent. The simulation parameters are summarised in Table I below:

TABLE I SIMULATION PARAMETERS

Parameter	Value
Transmitter range	40 meter
Simulation time	10 seconds
Pause time	0
Topology size	100×100 meter2
Number of nodes	50
Mobility model	Random Way Point
Speed	10m/sec

The key concept of the proposed work is to partition the radio transmission range of the mobile node into zones. Whenever there is a need to find path between sender and destination, sender uses RREQ packets. The location of each node in the network is stored in location matrix. Thus, sender finds three zones in direction where the destination lies .Then one node per zone is chosen to forward the RREQ. This node is called Incharge Node. The selection process is performed by determining the closest node to the edge of the zone as shown in Fig. 1 to provide more coverage area.

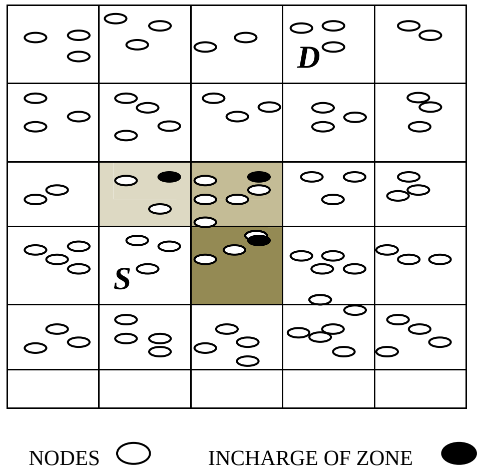

Fig. 1 Partition of Network Area into Zones

After locating the member nodes in each zone, next task is to find out the incharge node of each of these zones. This can be calculated by first calculating the distance from the sender node to each neighbour according to formula dist(source, mb) where mb represents an array containing the total number of members in that zone. Later, the node with maximum distance can be identified using max function. The equation will be max (dist (source, mb).Thus the member having maximum distance from the source will be nominated as Incharge of that particular node.

The sender attaches the address of the Incharge Node (IN) the into the RREQ field. Any neighbours when received the RREQ it will check if the sender select it as incharge node or not. If it is so, it will find the next three zones in the direction of destination and select a new set of Incharge Nodes and attach them into the RREQ and rebroadcast the RREQ, otherwise it will discard the RREQ.

On the reception of RREQ, each node checks field inside RREQ and the decision of rebroadcast is taken on the basis of inclusion of its network address in the list. If the node finds its address inside this field that means rebroadcast the RREQ will occur further otherwise discard it. Incharge Nodes when receive the RREQ, they check field and since they find themselves inside the RREQ therefore they do the same as node S and rebroadcast the RREQ.

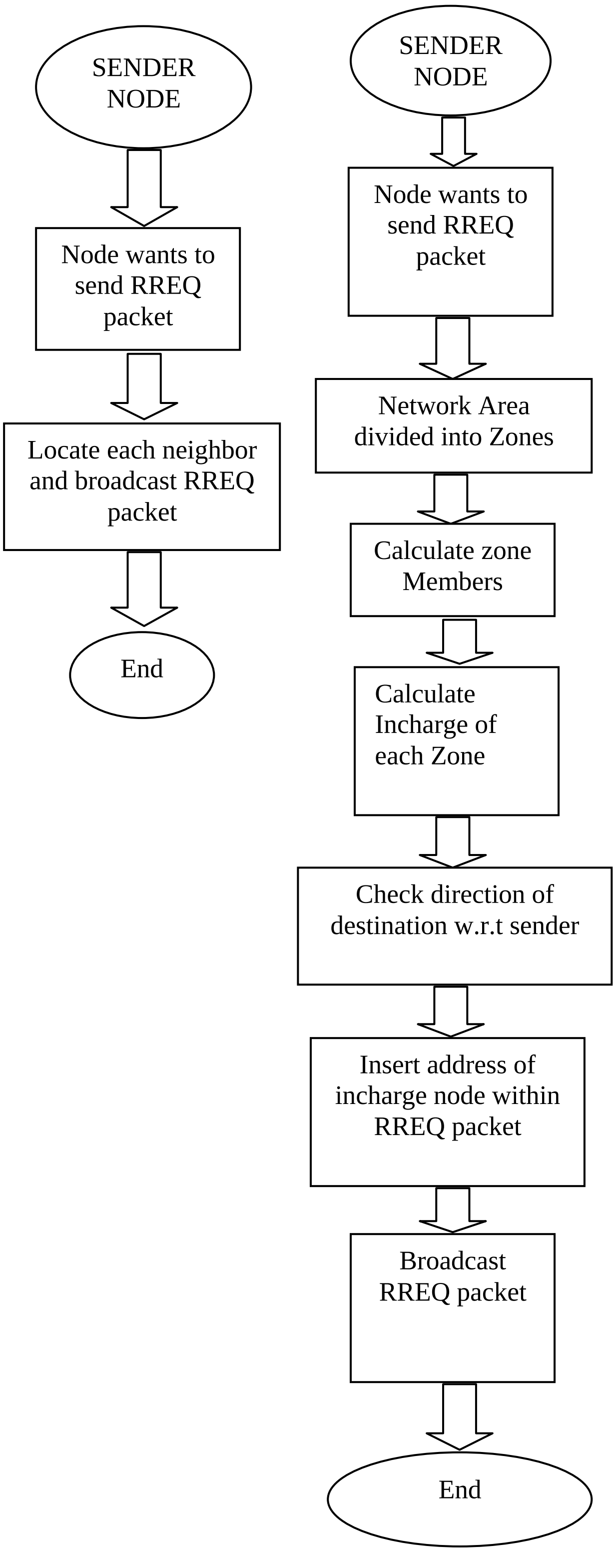

Fig. 2 Flowchart comparison between traditional method and new approach

IV. RESULTS AND DISCUSSIONS

This work is based on the literature research method relying on the materials listed in the references. In addition, the approach used in case study is to do simulations. The simulations are done with MATLAB.

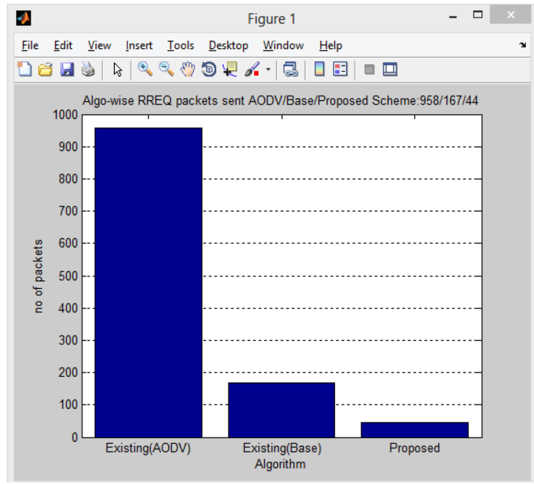

Fig. 3 Overhead Comparison

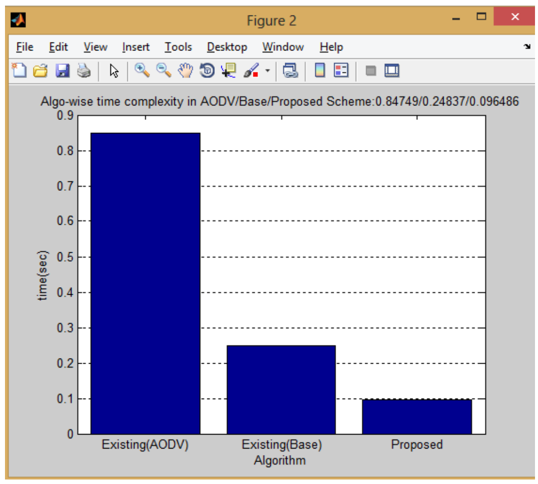

Fig. 4 Comparison of Time Complexity

A. *Performance Metrics*

We have used the MATLAB to conduct extensive experiments to evaluate the performance of Efficient Flooding Approach. The traditional method of route discovery uses simple flooding by broadcasting routing requests. Further we have implemented two variations: one using LAR protocol (4-zone concept), and the other using our Efficient Flooding Approach (3- zone). The main idea is to reduce the no. of rebroadcasts during route discovery, thereby reducing the network traffic and decrease the probability of channel contention and packet collision.

1) *Overhead*: Fig. 3 shows the overhead is very high in traditional method due to blind flooding whereas count decreases in next approach (use of LAR). Further, using the new efficient approach, there is remarkable decrease in RREQ packet. Thus it shows that Enhanced Flooding (LAR) performs better that traditional method, and this proposed approach performs even better than it.

2) *Time complexity:* Fig. 4 shows a large difference between times taken for route discovery between traditional methods, Enhanced flooding scheme (LAR) and proposed approach. This simply concludes that Enhanced flooding scheme performs better than traditional due to less

rebroadcast RREQs and proposed scheme performs even better than it as it takes least time.

3) *Throughput:* Throughput is a vital metric that measures the transmission ability of a network. It is defined as the number of bits transmitted within a unit time different flows settings. The figure shows that Proposed Scheme outperforms Enhanced flooding scheme (LAR) and Traditional route discovery method. The throughput improvement is due to its reduction of rebroadcasting and bounded requested zone. The fewer the rebroadcasts, the smaller bandwidth consumption by control messages and reduces area of route discovery. This also results in lower degree of contentions and collisions, which leads to relatively higher throughput.

V. CONCLUSION

The major focus of this work has been the design and analysis of new route discovery approach for routing protocol in MANETs that can significantly reduce the routing overhead that associated with the traditional simple flooding based route discovery while improving normalized network throughput.

Extensive simulation experiments have been conducted to compare the performance of this new flooding approach against the traditional flooding method. The results have revealed this new approach exhibit superior performance advantage in terms of routing overhead, time factor, normalised network throughput.

VI. FUTURE USE

Several interesting issues and unsolved problems that require further investigation have emerged. These are briefly outlined below.

This work has presented extensive performance analysis of efficient flooding algorithm. It would be an interesting prospect to examine the effects of this approach on the routing table advertisements in reactive protocols, such as DSR, proactive routing protocols, such as OLSR [11], and hybrid routing protocols, such as ZRP [12].

The random waypoint mobility model has been used in this dissertation to simulate node mobility and its impact on the performance of this route discovery approach. Although this particular mobility model has been widely used, there are several other models which account for different motion patterns. For instance, the community based mobility model models human movements within communities and among different communities, the Manhattan mobility model models vehicular mobility on structured roads in a city, and the Group mobility model models a motion pattern similar to military combat zones.

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