An Investigation of Zone Routing Protocol (ZRP) in Mobile Ad-Hoc networks

Shiksha Devi, Poonam Chaudhary

Abstract— In Mobile Ad Hoc Networks (MANETs), routing is a challenging task due to node mobility, traffic and network size. It is very important to analyze the scalability characteristics of the routing protocols with respect to these parameters. Zone Routing Protocol (ZRP) is considered to be one of the most scalable routing protocols due to its multi-scoping and hybridization features. We propose a general, parameterized model for analyzing control overhead of ZRP. A generic probabilistic model for data traffic is also proposed which can be replaced by different traffic models. Our analytical model is validated by comparisons with simulations performed under different network scenarios. The main objective of the project will be the transfer of information from node of one region to the node of another region but not at the expense of path length and energy. Network throughput should also be maintained to maintain the efficiency and decrease the power consumption of the system.

Index Terms— Mobile Ad Hoc Network, ZRP, DSR, Routing Protocols.

I. INTRODUCTION

A MANET is a type of ad hoc network that can change location and configure itself on the fly. Because MANET's are mobile, they use wireless connections to connect to various networks. This can be a standard WI-FI connection or another medium such as a cellular or satellite transmission. Some MANET's are restricted to a local area of wireless device (such as a group of laptop computers), while others may be connected to the internet. For example, A VANET i.e. "Vehicular ad hoc network", is a type of MANET that allows vehicles to communicate with roadside equipment, while the vehicles may not have a direct internet connections the wireless roadside equipment may be connected to the internet, allowing data from the vehicles to be sent over the internet. The vehicle data may be used to measure traffic condition or keep track of trucking fleets. Because of the dynamic nature of MANET, they are typically not very secure, so it is important to be cautious what data is sent over a MANET. [1] A Mobile Ad-Hoc Network (MANET) is a decentralized network of autonomous mobile nodes able to communicate with each other over wireless links. Due to the mobility of the nodes, the topology of the network may rapidly be changing, making it impossible to use conventional routing tables maintained at fixed points (routers). Instead, each node is required to determine the best route to a given destination node by itself. Given their dynamic nature, route discovery in a MANET differs significantly from the more or less static routes in wired networks: Not all nodes in a MANET necessarily have the same capabilities. Two nodes, even if they are direct neighbors, may differ with respect to signal strength, available power, reliability etc. These differences require much more complicated and particularly more active distributed algorithms in order to maintain an accurate picture of the networks topology, while at the same time providing scalability for potentially large (and ever-growing) networks. At the same time, route discovery must not use up the majority of the often limited bandwidth available to today's mobile devices. Furthermore, it is important to point out an important difference to conventional routing approaches: In wired networks, each link is bi-directional. If a node A can send packets to a node B, we know that node B can send packets back to node A, and a reverse path can be entered. This is not necessarily the case in a wireless network, where the physical location and the individual power resources have great influence upon a nodes transmission capacity and signal strength. MANET routing protocols are IP based and may use unicast, multicast or hybrid approaches and should allow for interaction with standard wired IP services rather than being regarded as a completely separate entity. [2].

The increasing use wireless portable devices such as phones and laptops is leading to the possibility for spontaneous or ad hoc wireless communication known as Mobile Ad Hoc Networks (MANET). A mobile Ad hoc network (MANET) is a self-configuring network that does not require any pre-existent (fixed) Infrastructure, which minimizes their deployment time as well as cost. As each node in this network is free to move which makes the network to change its topology continuously. These infrastructure-less mobile nodes in ad hoc networks dynamically create routes among themselves to form own wireless network on the fly Mobile Ad-Hoc Network (MANET) is one of the most active research topics during the last ten years. With the advances in wireless technologies and development of mobile devices, ad hoc networks will play a significant role in enabling present

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and future communication. For both video and data communication, mobile radio technologies has experienced a rapid growth. A MANET is a dynamic wireless network formed by a set of mobile hosts which communicate among themselves by means of the air without any pre-existing infrastructure. Each node in the MANET can act as a router as well as host. In order to maintain connectivity in a mobile ad-hoc network all participating nodes have to perform routing of network traffic [3].

II. RELATED WORK

A. Akshai Aggarwal, Savita Gandhi, Nirbhay Chaubey (2011) Mobile Ad hoc Networks(MANETs) are considered as a new paradigm of infrastructure-less mobile wireless communication systems. MANETs are being widely studied and it is the technology that is attracting a large variety of applications. Routing in MANETs is considered a challenging task due to the unpredictable changes in the network topology, resulting from the random and frequent movement of the nodes and due to the absence of any centralized control. In this paper, we evaluate the performance of reactive routing protocols, Ad hoc on demand Distance Vector (AODV) and Dynamic Source Routing (DSR) and proactive routing protocol Destination Sequenced Distance Vector (DSDV).The major goal of this study is to analyze the performance of well-known MANETs routing protocol in high mobility case under low, medium and high density scenario. Unlike military applications, most of the other applications of MANETs require moderate to high mobility. Hence it becomes important to study the impact of high mobility on the performance of these routing protocols. The performance is analyzed with respect to Average End-to-End Delay, Normalized Routing Load (NRL), Packet Delivery Fraction (PDF) and Throughput. Simulation results verify that AODV gives better performance as compared to DSR and DSDV [4].

B. Haruki osanai, Akio Koyama, Leonard Barolli. (2011) In Mobile Ad-hoc Networks (MANET), the nodes intercommunicate through single-hop and multi-hop paths in a peer-to-peer fashion. Intermediate nodes between two pairs of communication nodes act as routers. Thus, the routing protocols play an important role for construction of MANET. Though the research of the routing protocol for MANET is actively done, most performance evaluations are evaluated via simulation. In this research, we implemented the zone-based routing protocol called ZRP and EZRP to real machines and evaluated by real environment. In the evaluation results, we showed that EZRP which is our proposed protocol has better performance than ZRP [5.]

C. Brijesh Patel and Sanjay Srivastava (2010) In Mobile Ad Hoc Networks (MANETs), routing is a challenging task due to node mobility, traffic and network size. It is very important to analyze the scalability characteristics of the routing protocols with respect to these parameters. Zone Routing Protocol (ZRP) is considered to be one of the most scalable routing protocols due to its multi-scoping and hybridization features. We propose a general, parameterized model for analyzing control overhead of ZRP. A generic probabilistic model for data traffic is also proposed which can be replaced by different traffic models. Our analytical model is validated by comparisons with simulations performed under different network scenarios. In our simulation results, we have observed that the optimal zone radius lies at a point where proactive and reactive overhead components of ZRP are approximately equal. Further, as the mobility increases the optimal zone radius value decreases, and as the traffic increases the value of optimal zone radius increases. If a node operates away from the optimal zone radius setting then it has to bear additional routing overhead [6].

D. J. Haas, Marc R. Pearlman (2001) ZRP proactively maintains routing information for a local neighborhood (routing zone), while reactively acquiring routes to destinations beyond the routing zone. This hybrid routing approach can be more efficient than traditional routing schemes. However, without proper query control techniques, the ZRP cannot provide the expected reduction in the control traffic. A ZRP configuration that minimizes control traffic generally provides near-optimal route discovery delay. ZRP has been shown to respond twice as fast as traditional flood-search queries in multiple-channel networks. In the single-channel environment, ZRP's response time is comparable to that of flood searching, but with less routing control traffic. The improvements in route response time are even greater when we consider that a node can immediately provide routes for all of its routing zone nodes. [7]

III. METHODOLOGY/ PLANNING

- Firstly we make an area for deployment & that area is called deployment area. This area is placed across the length and breath.
- After that the deployment area is to be divided in to the zones for increasing the performance of the system and decrease the size of the network.
- Equal number of sensors nodes is deployed in each zone.
- Each zone has its zone header or representative. Zone header contains the information of the sensor nodes that is placed in that zone.
- For routing or transferring the information, there are different -2 paths from one node to another node or multiple paths.
- Then select the sender & the receiver through where the information is send & where it received.
- Then the information from the sender node will first go to the zone header.

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- Then all the zone headers will communicate each other for identify the receiver's zone header.
- Hence inter zonal information will be transferred from sender zone header to receiver zone header.
- Then the information will go from the receiver zone header & then from the zone header to the receiver node & create direct path for transferring the information.

- At the end, different parameters will be calculated to test the efficiency of the system. Like energy, time, path length or power consumption. The main approach was to reduce the loss of energy, therefore studying the energy efficiency. Then the simulation result that show the energy loss at each node, it may be 100 % or may be less.

IV. IMPLEMENTED RESULTS AND DISCUSSION

Following are the scenarios for the implementation of result. Firstly we have to write a script file in the MATLAB which uses the C language for the data.

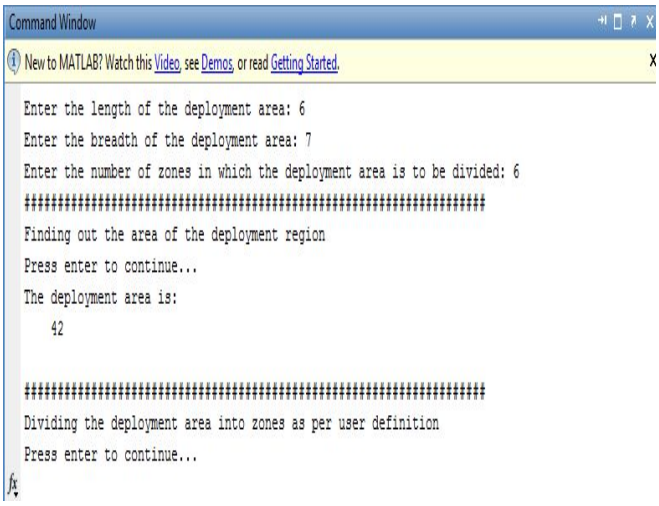

Figure 1: Deployment area with its length & breadth

Above fig show the codes for the deploy and the deployment area across the length 6, breadth 7, this is known as the deployment area or the total area for routing the information from one of one region to another zones of different region. The deployment area divided into different 6 zones.

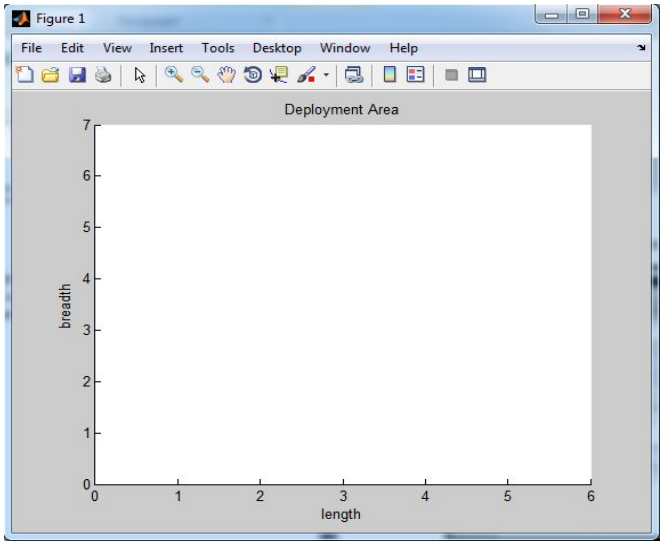

Figure 2: Deployment Area

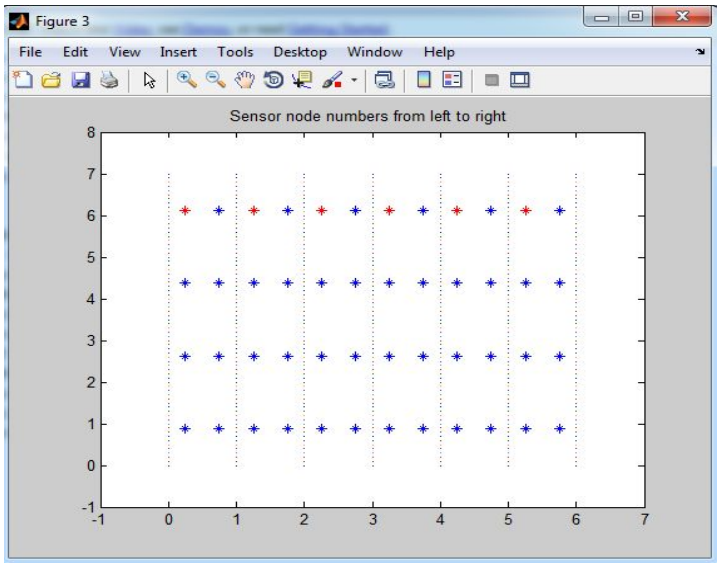

Figure 3: Number of sensor nodes in each zone

In above the deployment area that is divided into zones placed sensor nodes in each zone. After placing a sensor nodes the information about the sender node and the destination node is saved in to excel file i.e. ids file.

Here the sensors nodes will be placed in each zone. All zones contain same number of sensor nodes. In each zone there is a one zone header or representative that contains the whole information of that zone. In above fig the Red node is the zone header & the blue nodes is the sensor nodes.
From that excel file we take a sender node from the sensor nodes & the put the value from where we want to send the information. Then coordinators of sensor node is generate and based on the information the sensors node the mesh topology is used for making the connections between each sensor nodes.

Then from the excel file we give the value of input sensor node & the output sensor node like previously it also generate the coordinates of the value of sender node & the destination node.

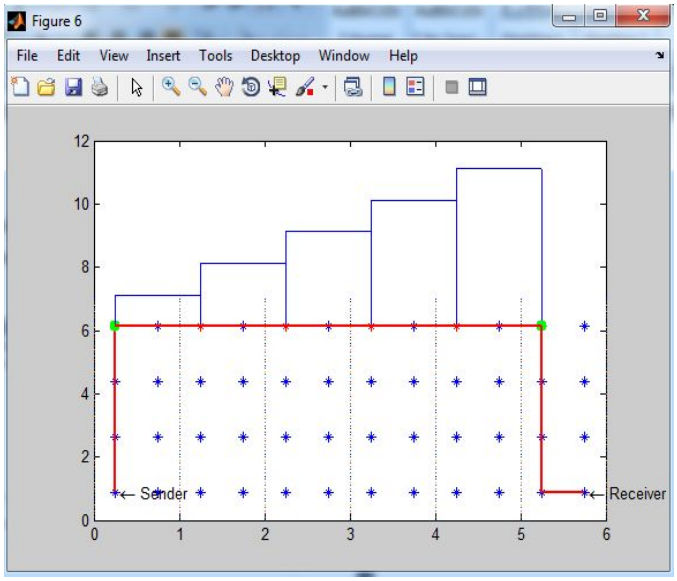

Figure 4: Formation of path from sender to the receiver

In figure 4 the sender node first go to that zone header because the each zone header contain information of that zone's sensor node. Each zone header will communicate with each other to identify the receiver node & through the internal zonal information the sender send the information to the destination node via zone headers.

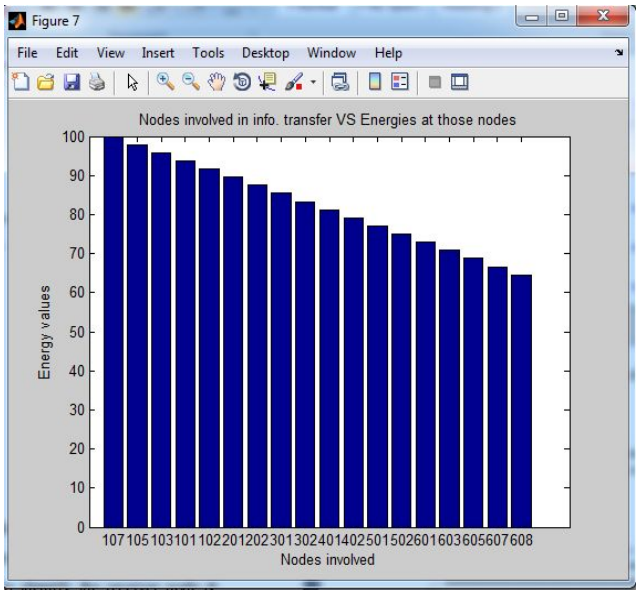

Figure 5: Nodes involved in information Vs Energies at those nodes

In figure 5 the energy loss is decreases at every node till the information is received. The overall distribution is finding at each node how much energy is loss.

Table 1: Energies at each node

Node ID	Energy Percentage	Node ID	Energy Percentage
107	100	401	81.25
105	97.92	402	79.17
103	95.83	501	77.08
101	93.75	502	75
102	91.67	601	72.92
201	89.58	603	70.83
202	87.5	605	68.75
301	85.42	607	66.67
302	83.33	608	64.58

Table 1 shows how much energy loss at each node is stored in excel form.

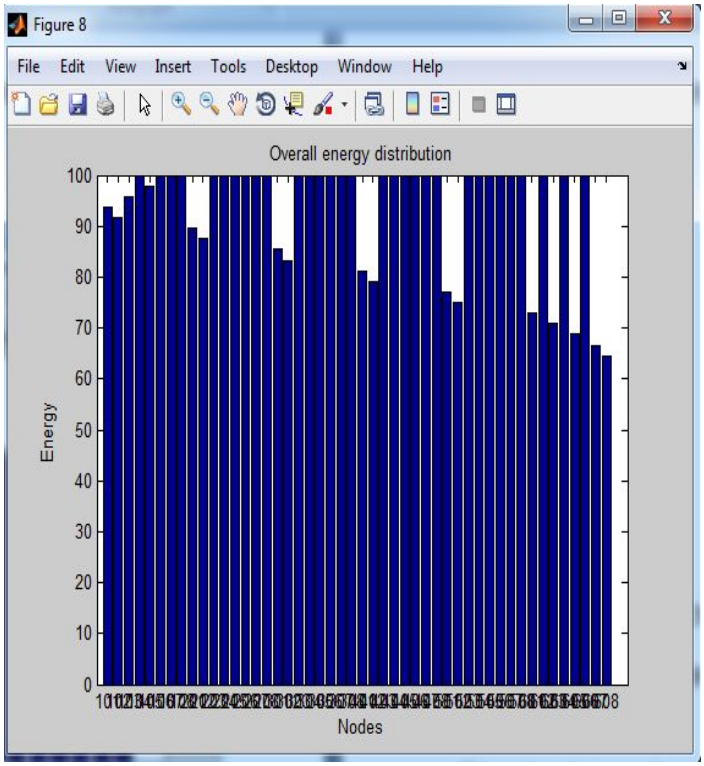

Figure 6: Overall energy distribution

Then the energy loss according to each zone & as like as the zone increases the energy loss will be decreases. How much energy will consume at each node this information is also write in a excel file named energy loss at each node.

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Table 2: Number of Nodes with Its Energy Loss percentage

Sender node	Destination node	Number of nodes	% of Energy lost
106	**604**	**16**	**31.2500**
101	**608**	**15**	**29.1667**
104	**602**	**14**	**27.0833**
103	**506**	**13**	**25**
101	**606**	**12**	**22.9167**
202	**507**	**10**	**20.8333**

Table 2 shows as well as number of nodes decreases the percentage of energy loss will also decrease. The energy lost at each node may be loss 100% or may be less.

V. CONCLUSION

This paper aims at routing of information through a network where the nodes are uniformly placed and are divided by zones. Communication between zone headers represented the low energy usage. Also, when sender zone header is searching for the receiver zone header, the search is not random search. It is strategically searching for the receiver zone header and it is stopping when it founds one in a short path. Hence, a lot of energy is saved during this efficient searching and routing part. As a future scope, we can assign some rules with which the zone headers will be selected. Also, the topology of the nodes placement can be enhanced based upon different protocols.

VI. REFERENCES

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VII. BIOGRAPHIES

Shiksha Devi recived the B.Tech. And M.Tech. Degree in Electronics and instrumentation Engineering and Electronics and Communication Engineering from M.MU. University and GJU&ST University. Her research interest include Wireless networks and routing approach.

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