Improving the Efficiency of MANET by Reducing Routing overhead using a NCPR protocol

Prajkta S. Nagrare, Vaishali N. Sahare

***Abstract*— A mobile ad-hoc network (MANET) is a set of mobile nodes that forms the temporary network without using infrastructure. Due to rapid movement of mobile nodes link breakage occurs, which lead to frequent path failures and route discoveries. Broadcasting mechanism is used for route discovery but it causes broadcast storm problem. With the help of Neighbor Coverage-Based Probabilistic Rebroadcast Protocol (NCPR) protocol, the existing system deals with the problem of route discovery which reduces the routing overhead. In MANET arrival of node and departure of node at any instant of time in the network causes mobility. MANET depends on the cooperation of intermediate nodes in order to forward or send packets that means multi hop link for data transfer. In the selected path if any intermediate node becomes faulty node after route discovery and faulty node causes the path failure. Path failure results data interruption, so it degrades the overall performance of the system. In proposed system, for path failure the path repairing approach is used, which enhance through AMRIS (Ad hoc Multicast Routing protocol utilizing increased id-numbers) protocol. AMRIS minimize the retransmission, reduce delay, improve packet delivery ratio and increase throughput. Hence performance and efficiency has been improved.**

Index Terms—**AMRIS protocol, MANET, NCPR protocol, Routing overhead, Path break, Path repair.**

I. INTRODUCTION

The Mobile Ad Hoc Network is the set of mobile nodes and continuously changing topology of nodes without using the infrastructure. Mobility is an important factor in MANET; due this the route discovery and path failure occurs. Route discovery is used to determine the path for data transmission between two nodes. But the nature of node in MANET is dynamic, therefore need of dynamic routing. AODV and DSR are two on demand routing protocols that deal with route discovery problem. AODV and DSR are used to reduce routing overhead with scalability. But for dynamic topology it is not good enough and inefficient because of frequent path breakage. Previously broadcast mechanism was used for route discovery process, but it creates broadcast storm problem [2]. Broadcasting protocols are classified into four types: "simple flooding, probability-based methods, area based methods, and neighbor knowledge methods." For the above four classes of broadcasting protocols, they showed that an increase in the number of nodes in a static network will degrade the performance of the probability-based and area-based methods [4]. Kim et al. [6] indicated that the performance of neighbor knowledge methods is better than that of area-based ones, and the performance of area-based methods is better than that of probability-based ones. To reduce overhead in route discovery process, Neighbor Coverage-Based Probabilistic Rebroadcast Protocol (NCPR) protocol has been used. NCPR approach uses the neighbor coverage knowledge and probabilistic mechanism to set rebroadcast probability [1].

NCPR protocol is used for route discovery and it selects the shortest path between source to destination. After selection of path between source to destination the data transfer begins. Arrival of node and departure of node at any instant of time in the network causes mobility. MANET depends on the cooperation of intermediate nodes in order to forward or send packets. If node does not participate in data transmission such nodes are called as uncooperative nodes. Due to mobility and uncooperative nodes the path breakage occurs. It causes retransmission of data and increase the end to end delay. Due to the occurrence of path failure, the efficiency of existing system decreases. There is no proper solution provided to repairing a path. So in order to make a system efficient proposed system use AMRIS (Ad hoc Multicast Routing protocol utilizing increasing id-numbers) protocol. In MANET uncooperative nodes are classified into three types:

1) Malicious node: Malicious nodes can enter network without authenticating themselves.
2) Faulty node: Faulty nodes because of hardware malfunction and software error will withdraw from the participation.
3) Selfish node: Selfish node does not forward packets since they want to save their own resources such as battery power for their own sending of packet.

Procedure for Paper Submission

II. LITERATURE SURVEY

Xin et al. [1], proposed a neighbor coverage-based probabilistic rebroadcast protocol (NCPR) is used to reduce routing overhead in MANETs. In MANETs, there are two types of problem occur i.e. route discovery & path failure due to mobility and insufficient battery node. The neighbor

Manuscript received Feb, 2016.

Prajkta Sudhir Nagrare, Department of Computer Science, Rashtrasant Tukadoji Maharaj Nagpur University,G. H. Raisoni Institute of Technology for Women, Nagpur, India , Mobile No:7756902621

***Vaishali N. Sahare**, Department of Computer Science, Working at G. H. Raisoni Institute of Technology for Women, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, India.*

coverage based probabilistic rebroadcast protocol which combines both neighbor coverage and probabilistic methods.

N. Karthikeyan et al. [2], proposed some schemes to decrease redundant rebroadcasts and distinct timing of rebroadcasts to improve this problem, thus routing performance get better. In a mobile ad hoc network (MANET) Broadcasting is a common method which resolves many issues in the network. Simply straight broadcasting is very costly and increases the number of overhead and thus problems like broadcast storm get occur.

Kim et al. [3], proposed a probabilistic broadcasting scheme uses the coverage area to set the rebroadcast probability. This system uses the neighbor confirmation to assurance reachability. Proposed system indicated that the performance of neighbor knowledge methods is better than that of area-based ones, and the performance of area-based methods is better than that of probability-based ones.

J. D. Abdulai et al. [4], proposed new probabilistic methods for on-demand route discovery, that is simple to implement and can significantly reduce the overhead involved in the dissemination of RREQs. The proposed approach dynamically sets the value of the rebroadcast probability for every host node according to the neighbor's information.

Zygmunt J. et al. [5], proposed simple gossiping approach each process periodically and randomly selects a partner with whom it exchanges recently observed information. Information disseminated by gossiping protocol spreads quickly and reliably with high probability. Also found that gossip-based approach can reduce network overhead by 35% as compared to flooding and gossip based approach is scalable. It is robust against failure and is global in the sense that trust is evaluated based on relevant system information but not based on local information.

Abdulai et al. [6], approaches a scheme of Dynamic Probabilistic Route Discovery (DPR) which is based on neighbor coverage. In this approach, each node determines the set of neighbors which are covered by the previous broadcast and this scheme only consist the coverage ratio by the previous node.

Keshavarz-Stann et al. [7], proposed a Robust Broadcast Propagation (RBP) protocol to give near great reliability for flooding in wireless networks, and this protocol also has a good efficiency.

Haddad et al. [8], proposed deterministic timer-based broadcast schemes: Dynamic Reflector Broadcast (DRB) and Dynamic Connector- Connector Broadcast (DCCB).Deterministic, timer-based broadcast schemes to only assurance full reachability over an optimistic lossless MAC layer; it provides strength against node failure.

Zhang et al. [9], proposed an estimated distance based routing protocol (EDRP) for limit the broadcast range of route request (RREQ) and minimize the routing overhead to monitor a route discovery in the common direction of a destination.

C. Siva Ram Murthy et al. [10], proposes multicasting protocol Ad Hoc Multicast Routing Protocol Utilize Increased Id Numbers. AMRIS is an on-demand protocol and the key idea that differentiates AMRIS from other multicast routing protocols is that each participant in the multicast session has a session-specific multicast session member id known as msm-id. The msm-id provides each node with an indication of its "logical height" in the multicast delivery tree. AMRIS protocol repairs path break locally.

III. METHODOLOGY

A. *Block Diagram of Proposed System*

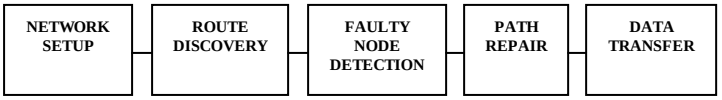

Fig. 1 Block Diagram of Proposed System

The block diagram of the proposed system is illustrated in Fig. 1. Each function of blocks is explained below:

I. Network setup: In this block the every deployed nodes sends topology discovery packet and hello message packet to other node in the network to show their presence for communication in the network.

II. Route Discovery: In this block by using NCPR protocol searching of the shortest path for source to destination is done. After selection of path between source to destination node every node is ready for participation of data transfer.

III. Faulty Node Detection: Detection of faulty node by checking whether the node is authenticated or not in the shortest path. If node is not authenticated node then path breaks and data transmission stops.

IV. Path Repair: In this block the path repair process is performed after fault detection by using AMRIS protocol.

V. Data Transfer: This block ensures the data transfer between source to destination.

B. *Flow Diagram of Proposed System*

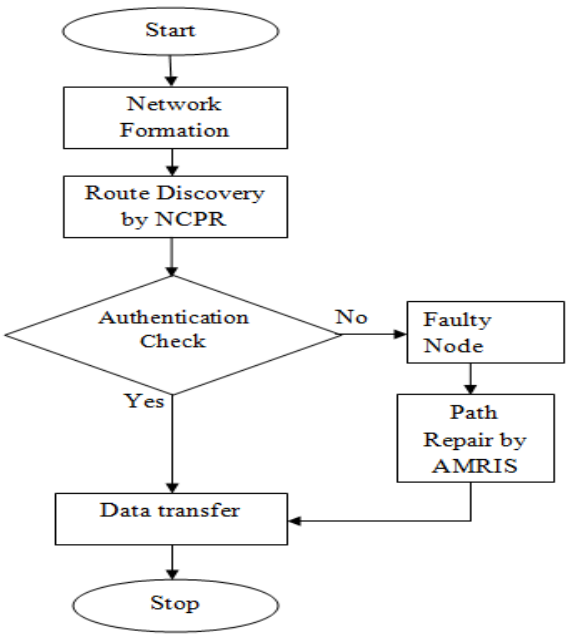

Fig. 2 Flow diagram of proposed system

Fig. 2 shows the flow diagram of proposed system. Network formation is done with deployment of nodes in the given simulation area systematically. By sending the hello message packets nodes discovers the topology. NCPR protocol is used for this route discovery process. The source and destination node are selected out of given nodes. The source node sends the route request packet to all other nodes. NCPR protocol uses the shortest path between source node to destination node. In given network some nodes are faulty node. For detection of faulty node authentication process takes place. If nodes are found with low battery power, hardware malfunction and software error are also faulty node. The proposed algorithm AMRIS is designed for repairing broken path due to presence of faulty node. AMRIS with new repaired path transfers the data to destination.

C. Proposed System

1) Route discovery

In any network the first step is route discovery i.e. finding route for data transfer for selected source to destination. In this proposed system NCPR protocol is used for route discovery which reduces the routing overhead [1].

2) Path Failure

After the successful path establishment between the source to destination the data transfer starts. In the network due to faulty node path breaks and data transfer is stopped.

3) Path Repair Process

The proposed system uses AMRIS protocol for path repairing [10]. For repairing the faulty node there are two criteria i.e. branch reconstruction 1 (BR1) and branch reconstruction 2 (BR2). In first criteria when any neighbor to source node become as faulty node then it will repair by BR1 criteria. Faulty node is replaced by new node which is selected on the basis of nearest distance from source node. In second criteria if the faulty node is not neighbor to source node then that faulty node is removed by BR2 criteria. In BR2 criteria another shortest path is selected on the basis of routing table.

IV. IMPLEMENTATION

A. Simulation Parameters

The following TABLE I shows the parameters required for simulation:

Table I

Parameters	Value
Routing Protocol	NCPR
Simulation Time	50 seconds
Simulation Area(mxm)	1800x800
Number of Nodes	50
Traffic Type	CBR
Pause Time	0.2 seconds
Mobility	10 meter /second
Packet Size(bit)	512
Data Rate	512
Mobility Model	Random Waypoint
MAC	802.11a
Channel Type	Wireless Channel
Transmit Power(W)	0.006
Energy Level	100 joules

B. Route discovery

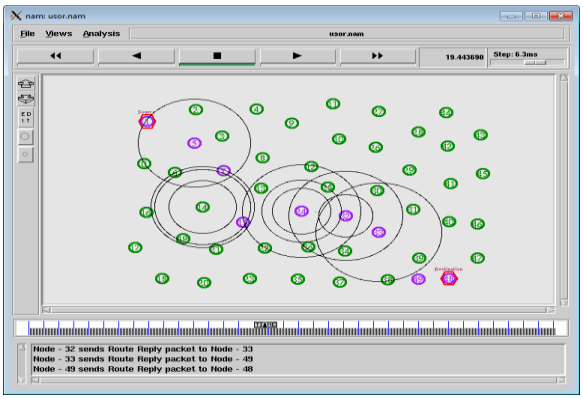

Fig. 3 Route Discovery

The topology formation in a simulated environment takes place by using NS2. Each node is allows to transmit a Topology Discovery packet to all the nodes. In network every node shows their existence by sending Hello packets to all nodes. As shown in fig 2, node 1 is source node and node 48 is destination node. Source node sends the route request packet to all neighboring nodes. NCPR protocol is used to check all nodes and determine shortest path between them. The simulation displays the selected shortest path and it consists of node 1-5-7-15-24-32-33-49-48 and violet colored nodes indicate the selected shortest path.

C. Path Failure

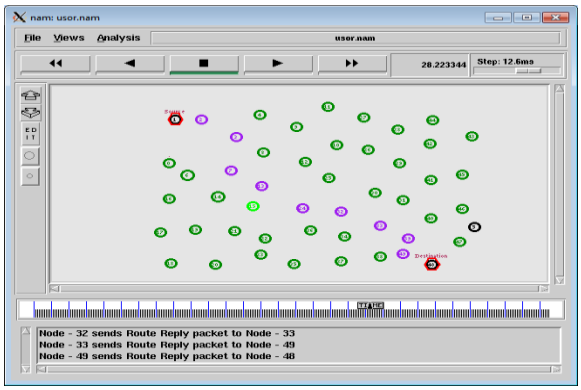

Fig. 4 Path Failure due to Faulty Node

As shown in fig 4, node 5 is detected as faulty node from the path 1-5-7-15-24-32-33-49-48 and path break is occur which causes the data interruption. The black colored node is faulty node and taken outside from path.

D. Path Repair Process

In this outcome the alternative path is selected due to detection of faulty node in the path. Node number 5 is faulty node and it is neighbor to source node. Faulty node is replaced by new node which is selected on the basis of nearest distance from source node. In simulation the violet colored nodes indicate the selected new shortest path.

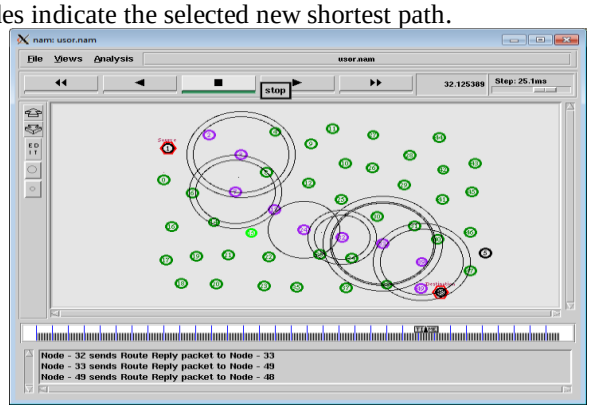

Fig. 5 Path Recovery and Data Transfer

The new selected path is 1-2-3-7-15-24-32-33-39-49-48 and the data transfer continued through the new selected path.

V. RESULT ANALYSIS

A. Throughput

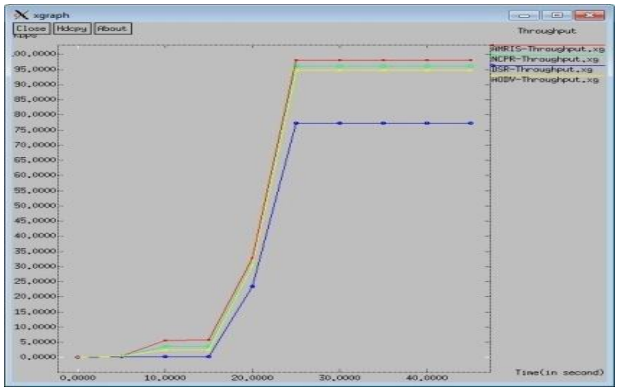

Fig. 6 Throughput Analysis

Fig. 6 shows comparative analysis for throughput. Throughput is defined as how much data can be transferred from source to destination. The X-axis represents "Time", while Y-axis represents "KB/S". From the graph it is clearly seen that the AMRIS protocol have greater value of throughput and thus increases the performance of system.

B. Packet delivery ratio

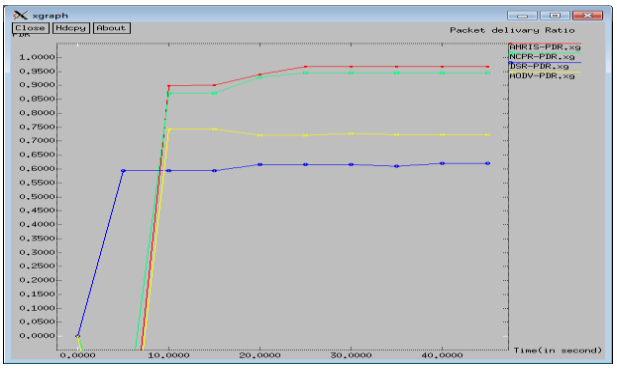

Fig. 7 Packet Delivery Ratio analysis

Fig. 7 shows comparative analysis for packet delivery ratio. Packet delivery ratio is ratio of number of data packets received by destination to number of packets send from source. This graph shows the packet delivery ratio from source to destination. The X-axis represents "Time", while Y-axis represents "PDR". Greater value of packet delivery ratio means better performance of protocol. Thus rate of success is increased in proposed system.

C. Average Delay

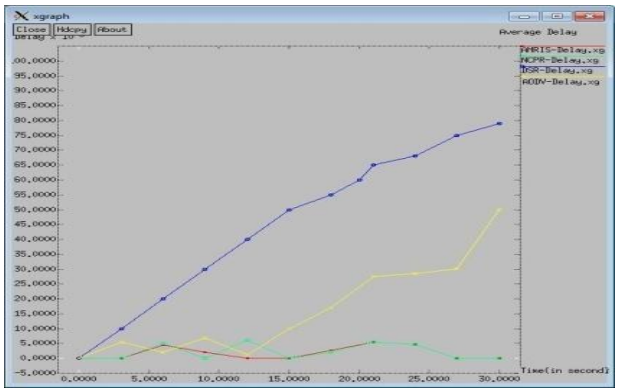

Fig. 8 Average Delay Analysis

Fig. 8 shows comparative analysis for average delay. This graph shows the average delay from source to destination. The X-axis represents "Time", while Y-axis represents "Delay". Lowest value of delay means better performance of system. From the graph it is clearly seen that the AMRIS protocol have lower value of delay. Therefore the transmission rate is increased in proposed system.

D. Packet Drop

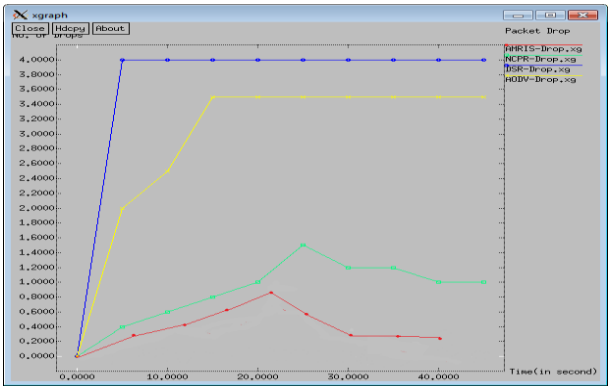

Fig. 9 Packet Drop Analysis

Fig. 9 shows comparative analysis specific for packet drop. Packet drop is the measure of number of packets dropped in network due to various reasons. This graph shows the packet drop. The X-axis represents "Time", while Y-axis represents "Number of drop". The red color line is used for AMRIS protocol, green line is used for NCPR protocol, blue line is used for DSR protocol and yellow line is used for AODV protocol. Lower value of packet drop means better performance of protocol.

VI. CONCLUSION

The proposed system uses NCPR protocol for reducing routing overhead and AMRIS protocol for reducing path failure problem caused by faulty node. The given system deals with the parameters such as average delay, throughput, and packet delivery ratio and packet drop. Simulation result shows the reduced average delay, reduced packet drop increased throughput, packet delivery ratio which further add the improve efficiency of proposed system.

REFERENCES

[1] Xin Ming Zhang, Member, IEEE, En Bo Wang, Jing Jing Xia, and Dan Keun Sung, Senior Member, IEEE, "A Neighbor Coverage-Based Probabilistic Rebroadcast for Reducing Routing Overhead in Mobile Ad Hoc Networks", IEEE Transactions on Mobile Computing, vol. 12, no.3, march 2013.
[2] N. Karthikeyan, Dr. V. Palanisamy, and Dr. K. Duraiswamy, "Performance Comparison of Broadcasting methodsin Mobile Ad Hoc Network", International Journal of Future Generation Communication and NetworkingVol. 2, No. 2, June, 2009.
[3] J. Kim, Q. Zhang, and D.P. Agrawal, "Probabilistic Broadcasting Based on Coverage Area and Neighbor Confirmation in MobileAd Hoc Networks," Proc. IEEE GlobeCom, 2004.
[4] J. D. Abdulai, M. OuldKhaoua, and L.M. Mackenzie," Improving Probabilistic Route Discovery in Mobile Ad Hoc Networks," Proc. IEEE Conf. Local Computer Networks, pp, 739-746, 2007.
[5] Zygmunt J. Haas, Senior Member, IEEE, Joseph Y. Halpern, Senior Member, IEEE, and Li (Erran) Li, Member, IEEE, "Gossip-Based Ad Hoc Routing", IEEE/ACM Transactions on Networking,vol. 14, no. 3, June 2006.
[6] J.D. Abdulai, M. Ould-Khaoua, L.M. Mackenzie, and A. Mohammed, "Neighbor Coverage: A Dynamic Probabilistic Route Discovery for Mobile Ad Hoc Networks," Proc. Int'l Symp. Performance Evaluation of Computer and Telecomm Systems (SPECTS'08), pp. 165-172, 2008.
[7] A. Keshavarz-Haddady, V. Ribeirox, and R. Riedi, "DRB and DCCB: Efficient and Robust Dynamic Broadcast for Ad Hoc and Sensor Networks," Proc. IEEE Comm. Soc. Conf. Sensor, Mesh, and Ad Hoc Comm. and Networks (SECON '07), pp. 253-262, 2007.
[8] F. Stann, J. Heidemann, R. Shroff, and M.Z. Murtaza, "RBP: Robust Broadcast Propagation in Wireless Networks," Proc. Int'l Conf. Embedded Networked Sensor Systems (SenSys '06), pp. 85-98, and 2006.
[9] X.M. Zhang, E.B. Wang, J.J. Xia, and D.K. Sung, "An Estimated Distance Based Routing Protocol for Mobile Ad Hoc Networks," IEEE Trans. Vehicular Technology, vol. 60, no. 7, pp. 3473-3484,Sept.2011. 11, pp. 34–39, Jan. 1959.
[10] C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks": Architecture and Protocols, Prentice Hall Communication Engineering and Emerging Technologies Series, Theodore S. Rappaport, 22nd edition 2014.

Prajkta Nagrare, M.E. completed in Wireless Communication and Computing, Department of computer science, G. H. Raisoni Institute of Engineering and Technology for Women, Nagpur, Maharashtra, India. Affiliated to Rashtrasant Tukadoji Maharaj Nagpur university.

Vaishali Sahare, currently working as professor in G. H. Raisoni Institute of Engineering and Technology for Women, Nagpur, Maharashtra, India. Affiliated to Rashtrasant Tukadoji Maharaj Nagpur university.

