

EFFICIENT UTILISATION OF BANDWIDTH AND CONTROLLED TRAFFIC LOAD ROUTE RECOVERY

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Abstract

Route failure is a vigorous issue in MANET that is mainly responsible for interrupted service between source and destination, so there should be some mechanism to handle this issue as soon as it is detected, to continue the transmission. In this paper we have proposed Multipath Routing a routing protocol which provides multipath discovery, efficient utilization of bandwidth and controlled traffic load route recovery at the time of failure. Approach at the time of failure the recovery node is selected from the neighboring nodes of node detecting failure ,by performing route discovery from node detecting failure and the neighboring node which is first to send the route reply packet from the destination to the node detecting failure is selected as recovery node and if the two neighbors of failure node send the route reply packet at the same time then the node with higher available bandwidth is selected in the mean while we send stop transmission till route recovery packet to source node through reverse path, as soon as new path is selected start transmission packet is sent to source to start transmission again and updates its cache by storing new route for transmission. **Results:** The proposed protocol is efficient in overcoming the problem of stale routes in multipath routing protocols. Also proposed protocol shows significant improvement in packet delivery ratio and reduced end to end delay.

Keywords: MANET, Multipath Routing Protocol, Fault Tolerance, Link Failure, RREP,RREQ.

Introduction

Mobile Ad Hoc Networks (MANET)

MANET is a self organizing network with autonomous mobile nodes connected dynamically in arbitrary manner through wireless links. These autonomous nodes can communicate with each other if and only if they are in transmission range of each other. As ad hoc network is economically

Beneficial, it is utilized in the military application, collective and distributed computing, emergency services, wireless mesh and sensor networks and even in hybrid networks

Routing in MANET

Routing protocols are mainly used for determining optimal packet routes for sending data between source and destination. Exchanging route information, gathering information about route breaks, repairing broken routes, load balancing are also some useful features of routing protocols.

Unipath Routing Protocols

Unipath Routing Protocols provide single route between source and destination for each data transmission session. In these protocols every node acts as a router that find route for transmission, maintain them and relay packets along the route.

There are two types of unipath routing protocols. First one is Proactive or Table Driven routing protocols, these protocols provide up-to-date topological view of network by constantly monitoring the known routes. If there is any change in the network all nodes in the network receive updates and also if source wants to send packet to destination route is already known. Examples of these protocols are DSDV, OSPF etc. Second type referred to Reactive or On Demand routing protocols, these protocols does not required constant updates as in these protocols route is discovered only when there is need to transmit data between source and destination. Examples of these protocols are DSR and AODV.

Hybrid Routing Protocols are combination of the above two unipath protocols. Examples of these protocols are ZRP and TORA.

Multipath Routing Protocols

Multipath Routing Protocols discover multiple routes between source and destination at the time of route discovery as alternate routes such that if there is any failure in primary path an alternate path can be used for recovery [R.L.Lagendijk, 2003]. These protocols are generally extensions to unipath routing protocols. Due to limited channel bandwidth, limited power and frequent mobility of nodes in MANET, the path connecting the source and destination may go down at any time. To abate these issues multipath routing came into existence in which alternate paths are determined.

Multipath Routing Protocols for Fault Tolerance

These types of routing protocols provide mechanisms to deal with faults in MANET. Due to random movements of node in MANET, it is prone to

various faults like failure of nodes, failure of link, breakage of routes and congested links [D. Jagadeesan ,2012]. These protocols follow proper route maintenance mechanism to provide appropriate route recovery at the time of failure by selecting the alternate route discovered at the time of route discovery in optimal way. Node Disjoint, Link Disjoint and Non Disjoint provide more fault tolerance.

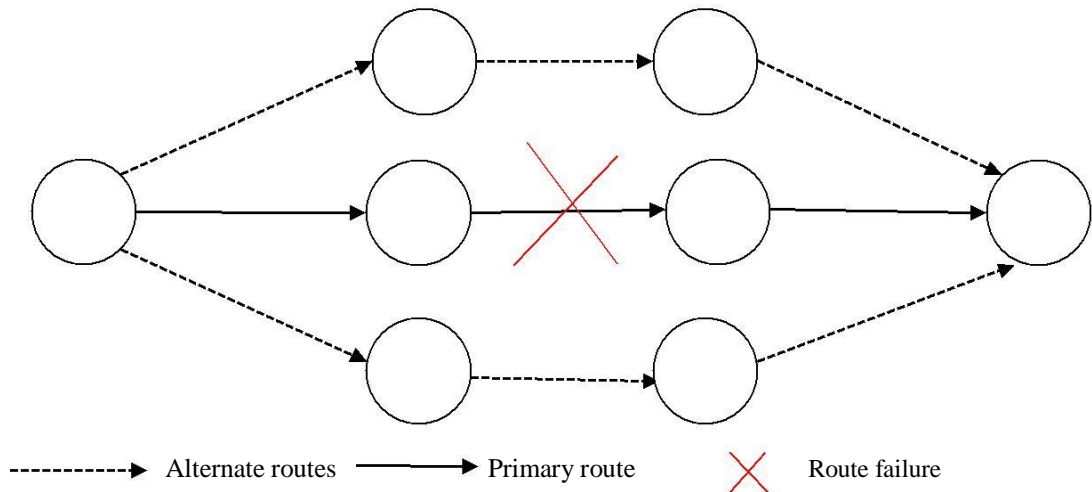


Figure 1: Route Failure in MANET

Problem Statement

Traditional on demand routing produces heavy routing traffic by blindly flooding the entire network with RREQ packets during route discovery. The routing overhead associated with dissemination of routing packets is quite huge especially when topology changes [2] .Multipath routing protocols cache multiple routes to a destination in a single route discovery. However, in presence of mobility, multipath protocols incur additional packet drops and delay due to their dependency on potentially stale routes from caches Protocols using either limited broadcast or local recovery have focused on reducing packet drops and not on utilizing the bandwidth efficiently during route recovery[D. Jagadeesan, 2012].Multipath routing protocols involving multipath discovery and local route recovery at the time of node mobility creates additional burden and heavy traffic load on the network by selecting recovery node as random overhearing node.

So we propose an enhanced routing protocol which provides multipath discovery and controlled traffic load route recovery at the time of failure. Whenever a link or a route break occurs, a route recovery is performed which in turn invokes the alternate route selection from the available nodes on the basis

of the neighboring node which is first to send route reply packet from destination if there are more than one node sending packet at same time then node with higher available bandwidth will be selected. The proposed routing protocol has the following advantages:

- Reduces packet drops
- Controlled traffic load at the time of route failure
- Provide optimal routes
- Utilize bandwidth efficiently
- Loop-free
- Reduce stale routes problem

Proposed Work

We propose an enhanced routing protocol which provides multipath discovery and controlled traffic load route recovery at the time of failure. When the source wants to forward packets to the destination it broadcast the route request packets (RREQ) to whole network. The RREQ propagation from source to destination establishes multiple reverse paths both at intermediate nodes and destination. The multiple paths discovered are loop free and disjoint paths. The destination node upon receiving all RREQ packets attaches the route code consisting of route bandwidth and feedback Route Reply (RREP) packets. These multiple RREPs traverse reverse paths back to from multiple forward paths to the destination at the source and intermediate node. After receiving RREP packets, the source node selects the primary route on the basis of route with higher bandwidth. In case of route failure in primary route the node detecting failure performs the route recovery procedure. The route recovery technique is performed to avoid congestion and degradation in network.

Route Discovery

Step 1: Whenever data packets are needs to be forward by the source node to the destination, the RREQ packets are flooded to entire network. Since RREQ is flooded network-wide, a node may receive several copies of the same RREQ. These duplicate copies can be gainfully used to form alternate reverse path.

Step 2: The reverse paths are formed only using those copies that preserve loop freedom (never form a route at a downstream node via upstream node) and disjointness (ensure the last hops and the next hops before destination are unique) among the resulting set paths to the source.

Step 3: If route information to the destination is present in the route cache of intermediate node, it has no permission to send Route Reply (RREP) back to the source, permission is given only to the destination node.

Step 4: The destination upon receiving all RREQ packets attaches route code and sent it as RREP packet. Upon reception of RREP packets the source selects the primary route on the basis higher bandwidth.

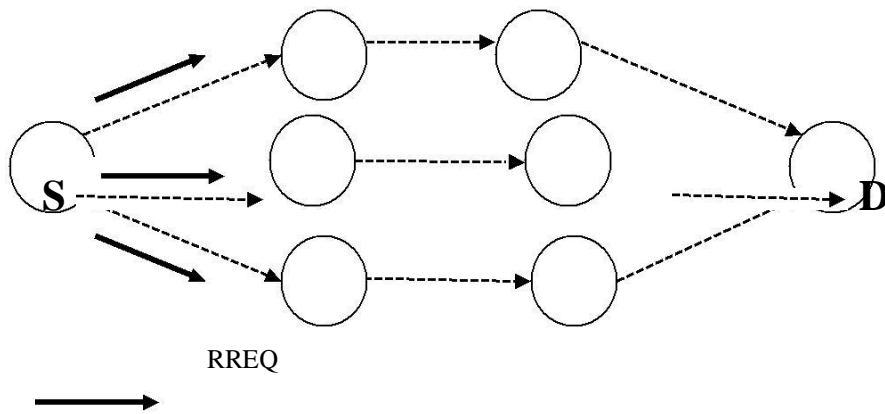
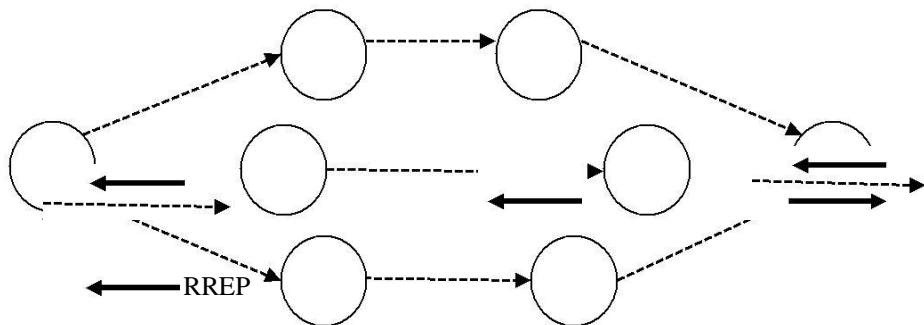


Figure 2: Shows flooding of RREQ by Source



Destination Sending RREP, setting a forward and reverse path, and intermediate nodes update their routing cache.

Figure 3: RREP by Destination

Route Recovery

Step 5: In case of route failure in primary route the recovery node is selected from the neighboring nodes of node detecting failure by performing route discovery from node detecting failure. Now the node detecting failure starts route discovery.

Step 6: In the mean time send Stop Transmission till route recovery packet to source node through reverse path to control congestion.

Step 7: The neighboring node which is first to send the route reply packet from the destination to the node detecting failure is selected as recovery node.

Step 8: If the two neighbors of failure node send the route reply packet at the same time then the node with higher bandwidth is selected as recovery

node.

Step 9: As soon as new path is selected a start transmission packet is sent to source to Start transmission again and updates its cache by storing new route for transmission.

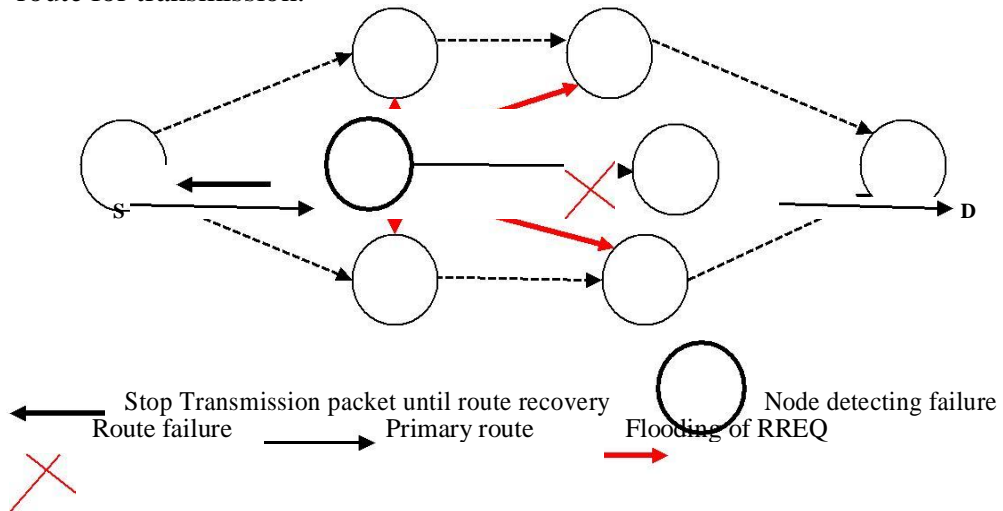
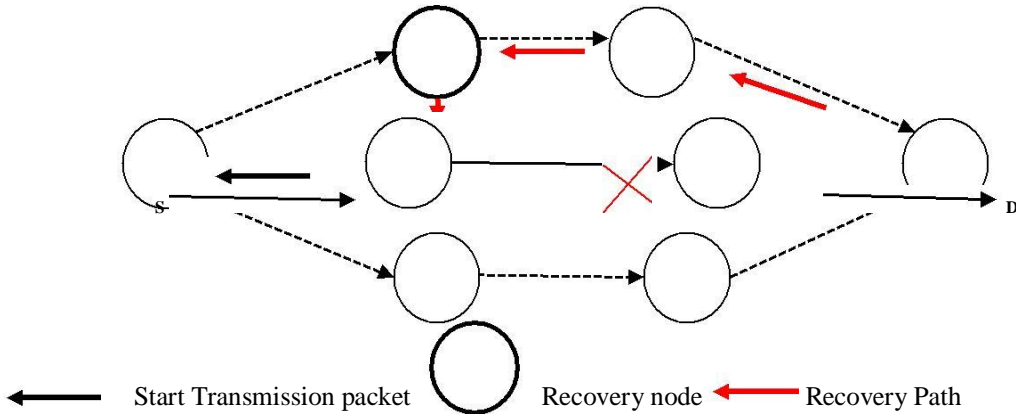


Figure 4: Route Failure in Primary Route and Re Route Discovery by Node Detecting Failure



Neighboring node first to send route reply packet is considered as recovery path and after that start transmission packet is sent to source to start transmission again.

Figure 5: Shows Recovery Path and Start Transmission Packet to Source.

Detailed flowchart of Route recovery.

Detailed flowchart represents the pictorial overview view of protocol.

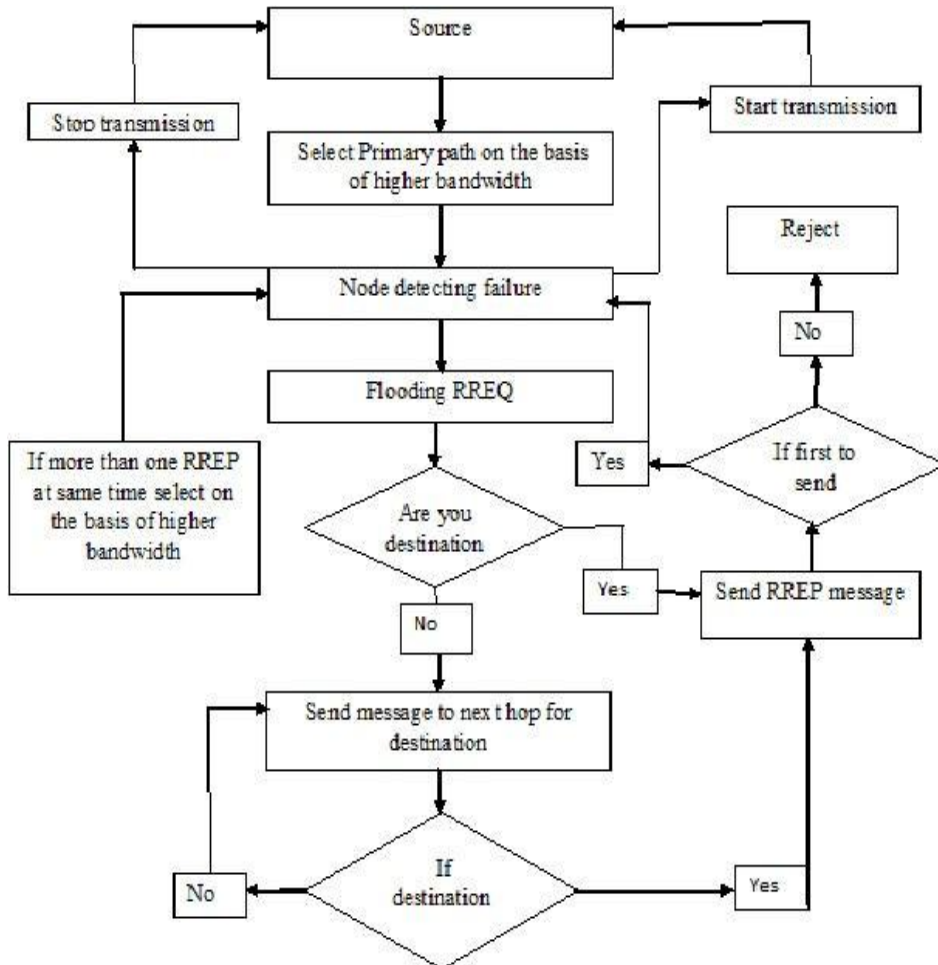


Figure 6: Flow diagram of EMPRR protocol

Results and Discussion Simulation**model and parameters**

We use NS2 to simulate our proposed protocol. In our simulation, the channel capacity of mobile hosts is set to the same value: 2 Mbps. We use the Distributed Coordination Function (DCF) of IEEE 802.11 for wireless LANs as the MAC layer protocol. It has the functionality to notify the network layer about link breakage. In our simulation, mobile nodes of sizes 5, 15, 25, 30, 50 and 60 move in an 800×800 m region for 05 seconds simulation time. We assume each node moves independently with the same average speed. In our simulation, the minimal speed is 5 m sec⁻¹ and maximal speed is 25 m sec⁻¹. The simulated traffic is TCP (ftp). Our simulation settings and parameters are

summarized in Table 1.

Table 1: Simulation parameters

Parameter	Value
Simulator	NS 2.35
MAC Type	802.11
Routing Protocol	EMPRR
Channel Type	Wireless Channel
Antenna Model	Omni
No.of Nodes	5,15,25,30,50 and 60
Area Size	800*800
Simulation Time	5 secs
Traffic Source	TCP(ftp)
Mobility Model	Random way point
Radio Propagation Model	two way ground
Interface Queue Type	Droptail/priqueue
Max packet in queue	50

Performance metrics

Performance Metrics are quantitative measures that can be used to evaluate any MANET routing protocol. We compare our EMPRR protocol with the AOMDV protocol. We evaluate mainly the performance according to the following metrics [Trung, H.D, 2007].

Average end-to-end delay

The end-to-end-delay is averaged over all surviving data packets from the sources to the destinations.

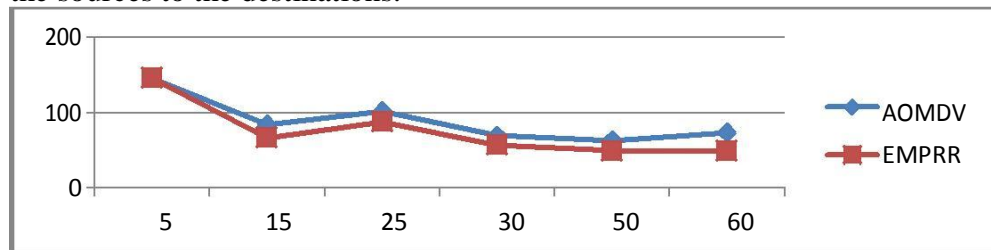


Figure 10: Nodes Vs Delay

Average packet delivery ratio

It is the ratio of the number of packets received successfully to the total number of packets sent.

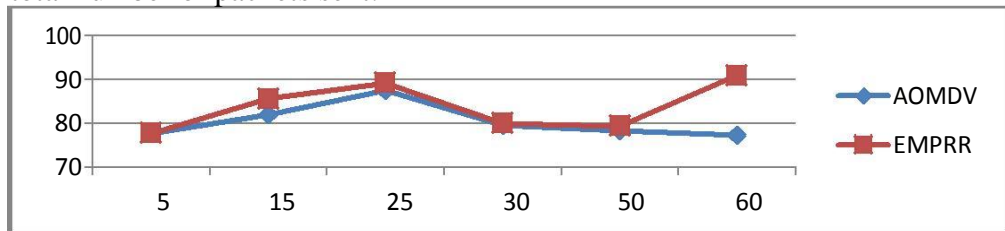


Figure 11: Nodes Vs PDR

Average Throughput

Average Throughput is the number of bytes received successfully.

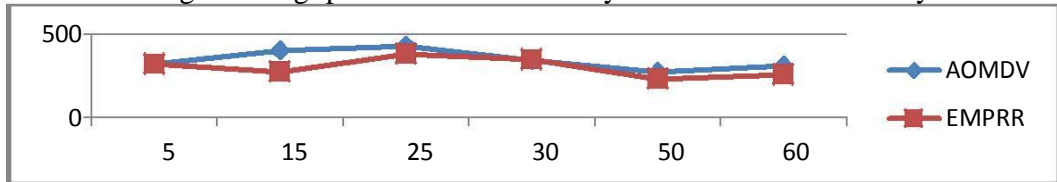


Figure 12: Nodes Vs Throughput

Drop

It is the number of packets dropped during the data transmission.

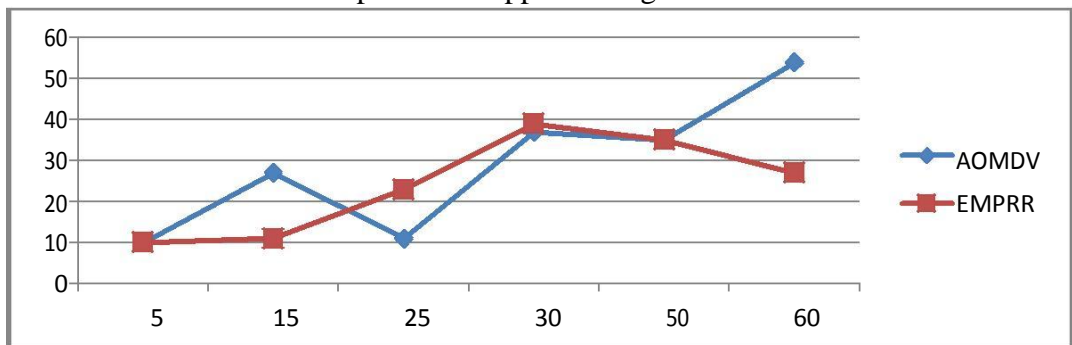


Figure 13: Nodes Vs Drop

Routing Overhead

Routing overhead is the total number of control packets or routing packets generated by routing protocol during simulation and is obtained by

$$\text{Routing Overhead} = \text{Number of RTR packets.}$$

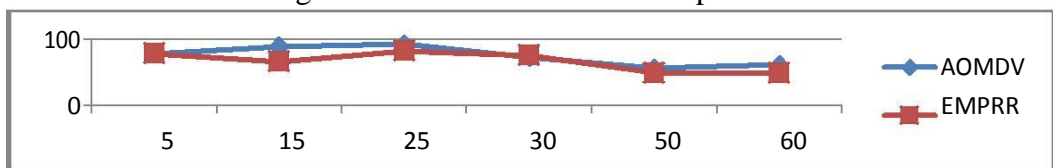


Figure 14: Nodes Vs Overhead

Based on nodes

In the initial experiment we vary the number of Nodes as 5, 15, 25, 30, 50 and 60. From Fig. 10; we can see that the average end-to-end delay of the proposed EMPRR protocol is less when compared to the AOMDV protocol. From Fig. 11, we can see that the packet delivery ratio for EMPRR increases, when compared to AOMDV, since it utilizes robust links. From Fig. 12, we can see that the throughput for EMPRR is almost equal to AOMDV. From Fig. 13, we can see that the packet drop for EMPRR is less, when compared to AOMDV. Figure 14 shows the overhead of the protocols. The values are considerably less in EMPRR when compared with AOMDV.

Table 2: Result Analysis of Proposed Protocol (EMPRR)

Protocol	No. of Nodes	End to End Delay	PDR	Throughput	Packet drop	overhead
EMPRR	5,15,25,50,60	Reduced	Increased	Min.	Less	Reduced

Conclusion and Future Work

In this paper we have proposed a routing protocol which provides multipath discovery, efficient utilization of bandwidth and controlled traffic load route recovery at the time of failure. The proposed protocol is efficient in overcoming the problem of stale routes in multipath routing protocols. Also proposed protocol shows significant improvement in packet delivery ratio and reduced end to end delay. In future researchers can develop hybrid multipath routing protocols that will provide feature of fault tolerance at the time of failure of node, failure of link and breakage of route and also balance load at the time of large volume traffic and finally increase quality of service aspects of multi path routing protocols. As in our protocol throughput didn't show large variation.

References:

- Ahmed Alghamdi, John DeDourek, Przemyslaw Pochech, Simulation of Carry Protocol (c-protocol) for MANET Network, *FUTURE COMPUTING 2012: The Fourth International Conference on Future Computational Technologies and Applications*, IARIA, 2012. ISBN: 978-1-61208-217-2, 2012
- Aminu, M., M. Ould-Khaoua, L.M. Mackenzie, C.Perkins and J.D. Abdulai, Probabilistic counter-based route discovery for mobile ad hoc networks. Proceedings of the 2009 International Conference on Wireless Communications and Mobile Computing: Connecting the World Wirelessly, (WCMC' 09) ACM New York, NY, USA, pp: 13351339.DOI:10.1145/1582379. 158267, 2009
- Dhirendra, K.S., S. Kumar and C. Kumar, Enhancement of split multipath Routing protocol in MANET. *Int. J. Comput. Sci. Eng.*, 02: 679-685, 2010
- D. Jagadeesan and S.K. Srivatsa, Multipath Routing Protocol for Effective Local Route Recovery in Mobile Ad hoc Network, *Journal of Computer Science* 8(7): 1143- 1149, 2012, ISSN 1549-3636© 2012 Science Publications , 2012
- Ha Duyen Trung and Watit Benjapolakul, A Caching Strategy for Multiple Paths in Mobile Ad Hoc Networks, *ECTI TRANSACTIONS ON ELECTRICAL ENG.,ELECTRONICS, AND COMMUNICATIONS*, VOL.5, NO.2 August 2007
- Kang, B.S. and I.Y. Ko, Effective route maintenance and restoration schemes in Mobile adhoc networks, *Sensors*, 10: 808-821, 2010
- Khalid Zahedi and Abdul Samad Ismail, Route Maintenance Approach for Link Breakage Prediction in Mobile Ad Hoc Networks (*IJACSA*) *International Journal of Advanced Computer Science and Applications*, Vol. 2, No. 10, 2011.
- Praveen Yadav, Joy Bhattacharjee and Roopali Soni, A Novel Routing Algorithm Based on Link Failure Localization for MANET, *International Journal on Computer Science and Engineering (IJCSE)*, Vol. 4 No. 10 Oct 2012.
- Rajesh.T, Rajesh.Y , Kishore Babu.T and Vidya Sagar.V, A Survey on Alternate Route Finding in MANET using Backtracking Algorithm: Recovery Issues, *The International Journal of Computer Science & Applications*, ISSN –2278-1080, Volume 1, No. 10, December 2012 .