Reducing Link Breakage in MANETs using Enhanced AOMDV

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Abstract: Manets are characterized by the mobile nodes moving randomly in the network. Lesser batteries is one of the features of the nodes deployed in the mobile ad hoc networks. Since these networks are decentralized in nature, therefore any node is free to join the network or leave the network without informing any centralized authority. The mobile ad hoc networks suffer from issues of link breakage arising out of constantly changing topology. This works aims at solving the issues by making use of modified leapfrog algorithm. The traditional routing protocol such as AOMDV or AODV etc. make use of broadcasting the RERR packets in case of link breakage between the nodes. This broadcasting does repairs the route, but consumes lot of energy of the network. The modified leapfrog algorithm, on the other hand, chooses one common neighbor of the nodes (whose link has been broken) to repair the route. The algorithm is quick and is energy-saver. The performance of the network has been compared with state-of-the-art routing protocol based on the PDR, throughput and remaining energy in the network. The performance of the proposed LP-AOMDV shows improvement over the existing work.

Keywords: MANETs, Leapfrog, throughput, PDR, AOMDV, Link breakage

I. Introduction

Manets are characterized by the mobile nodes moving randomly in the network. Lesser batteries is one of the features of the nodes deployed in the mobile ad hoc networks. Since these networks are decentralized in nature, therefore any node is free to join the network or leave the network without informing any centralized authority [1]. This leads to constant creation and disruption of the links between the nodes. Many routes tend to go stale therefore, most of the routing protocols used in these networks are reactive in nature. The routes are formed in the network between sender and destination as and when required. In MANETs, the limited battery capacity of a mobile node affects network survivability since links are disconnected when the battery is exhausted and links are also disconnected when the nodes move out of range of each other due to their constant movements. Therefore, a routing protocol considering the mobile nodes energy as well as their link rupture issue is essential to guarantee network connectivity and prolong the network lifetime.

Many researchers in the past have worked on Power-aware routing protocols that deal with the techniques that reduce the energy consumption of the batteries of the mobile nodes. This approach is basically done by forwarding the traffic through nodes that their batteries have higher energy levels. This tends to increase the network lifetime. By using such power aware routing protocols, various routing costs and path selection algorithms have been investigated for the purpose of improving the energy efficiency in the MANET [2]. In addition, the traditional routing protocol such as AOMDV or AODV etc. make use of broadcasting the RERR packets in case of link breakage between the nodes. This broadcasting does repairs the route, but consumes lot of energy of the network. Thus, this work proposes an energy efficient and quick route reply mechanism that repairs the link between two nodesin the network.

Section II represents the brief survey about the routing techniques in MANETs. Proposed workhas been represented in Section III. It gives details about the scheme implemented. The results are shown in Section IV.

II. Literature Survey

Aqeel Taha, Raed Alsaqour, Mueen uddin, Maha Abdelhaq and Tanzila saba introduced a system as Energy Efficient Multipath Routing Protocol for Mobile Ad-Hoc Network using the Fitness Function. To enhance the energy consumption in ad-hoc on demand multipath routing protocol, the authors developed a function called fitness function which is used to detect the optimal way from source node to the destination node. Also, we can say this system as FF-AOMDV (Fitness Function-Adhoc on Demand Multipath Routing Protocol). By utilizing Network Simulation-2, we can estimate the performance of the FF-AOMDV protocol. The authors also proposed another technique as Ad-hoc on Demand Multipath Routing with Life maximization which is to improve the lifetime of the network (AOMR-LM). The performance of the above mentioned technique is compared with AOMDV. After the comparison process, it estimates based on energy consumption, throughput, packet delivery ratio, end-to-end delay, network lifetime as well as routing overhead ratio performances and so on. The obtained result displayed that the proposed system is much better when compared to AOMDV [3].

P. Yazhini and Rajadevi. R introduced a system based on Link-Stability and Energy Aware Routing Protocol in Distributed Wireless Networks. Due to the restricted bandwidth modify the communication; there is a possibility to vary the link often. In the preceding research, the routing protocols like DSR, AODV chooses the shortest way among the source to destination. There is a possibility to link failure due to did not checking the stability for link stability. It may leads to more energy consumption ought to recover the data from the link failure.To overcome the above mentioned problems, the authors proposed a system called, Link Stability and Energy aware routing. Here they used an algorithm named as Link Stability and Energy aware routing. The energy efficiency of the network has been illustrated by the Delivery Probability based upon Route Stability protocol. By the usage of residual energy of the nodes, the stability of the network has been explained in the network. So, there is probability to reduce the link failure in the network. In terms of Collision rate as well as Average energy consumption, the performances of the protocol have been estimated [4].

Sofian Hamad, Salem Belhaj and Muhana M. Muslam introduced an Average Link Stability with Energy-Aware Routing Protocol for MANETs. Here, the authors described about the paper are categorized into two parts. One is a node should have Residual Energy (RE) prior to retransmitting the Route Request (RREQ) as well as in the end-to-end path, it will act as participating node. The assessment to comprise nodes in an e2e path is support on residual energies (RE). Another one is it should be an adequate, Link Life Time (LLT) among the source node to the receiving node ahead of transmitting the received RREQ. The blend of these two conditions gives greater security to the way as well as less continuous course breaks. The normal consequences of the reproductions gathered from the recommended A-LSEA convention demonstrated a genuinely huge change in the conveyance proportion surpassing 10% and an expansion in the system lifetime of around 20%, contrasted with other re-dynamic directing conventions. The particular nodes are permitted to transmit the received RREQs. The authors took the decision to retransmit the received RREQ packet to detect the best possible range for the LLT as well as RE instead of using a standard or approximate value of threshold in future aspects [5].

Floriano De Rango, Francesca Guerriero and Peppino Fazio proposed a technique as Link-Stability and Energy Aware Routing Protocol in Distributed Wireless Networks. To propose the protocol as well as algorithm, there are two essential factors such as, energy awareness for calculation as well as protocol organization. On the other side, the following protocols have been proposed to regard as the pathway extent in command to esteem several QoS control as well as to decrease the route detection dealings and the protocols are node mobility and scalable routing scheme. A novel routing scheme is introduced. To minimize the drain rate energy expenditure as well as for link constancy, we proposed this novel routing scheme. A new routing protocol has been constructed to authenticate the accuracy of the proposed solution called Link-constancy and Energy aware Routing protocols (LAER). The achievement of the above mentioned protocol has been estimated in terms of Data Packet Delivery Ratio, Normalized Control Overhead, Link duration, Nodes lifetime as well as Average energy expenditure has been compared with the following three protocols as PERRA, GPSR and E-GPSR [6].

Manish Chandra Joshi and Saswat Chakrabarti implemented a model as A Modified Signal-Stability based Adaptive Routing Protocol for MANET. Here, the authors proposed a Modified SSA from the technique of SSA (Signal Stability based Adaptive Routing protocol). To choose routes in ad hoc network, we proposed a SSA method which uses signal strength as well as location stability. To make it much better, the authors proposed a Modified SSA. In SSA, initially, the source sends a route discovery request that it has the packets which are send to the destination. Then the destination will accept the route discovery packet if it is free. After that the packets has been transmitted from the source to the destination. If the packets are weak, it breaks. Furthermore, the source searches the broken packets and after detecting the packet, it will retransmit the packets to the destination. But in Modified SSA, it will identify the weak packets while transmitting and it will automatically search the weak packets before it was broken. When it reaches a particular time, it will detect the weak packets and can have the capability to retransmit the packets. So, this scheme is a time consuming method. The overall performance is much better when compared to others [7].

Ms. Komal Badhe and Dr. Shitalkumar Jain discovered an Implementation of Mobility and QoS Aware Energy Efficient Anycast Routing in MANET. MANET is a self-motivated system and also it needs restricted energy as well as resources. An information travel via the host as well as every intermediator host will act as a router. Hence, it is complicated to estimate the future network topology or location of the host. Anycast Routing is referred as one to one of several links, also in anycast routing, the destination distribute the similar IP address. One can say the above mentioned routing as a simplest way of communication. Due to packets routed to the nearest destination, the operating cost is low. Moreover, while transmitting the packets, it has the ability to save power, network bandwidth as well as message collision. Another two major components are considered in MANET as QoS and the network topology stability. To overcome the entire above mentioned dilemma, the proposed protocol has been categorized into 3 major parts as (1) to recognize the stable nodes in the system, we can use Consistency model, (2) traffic model which is used to avoid traffic into QoS in the system and (3) to ensure the link period within the adequate range, energy model is used. The performance of the entire network is better and comparison between the protocols will be efficient in their characteristics [8].

Sajjad Jahanbakhsh Gudakahriz, Shahram Jamali, Mina Vajed Khiavi and Alireza Soleimani proposed a system as a stable TORA based for routing in mobile ad hoc networks. A compilation of mobile hubs in the absence of centralized access point or else active communications are referred as mobile ad hoc networks. Hubs are forever affecting as well as it may perhaps go into or departure

commencing the network at every time. Since inbuilt node restrictions, the description of the arrangement is little node energy level. The aim of the concept is to stabilize TORA protocol in which it is a disturbed routing protocol having more adjustment, competence as well as correctness for huge as well as intense mobile ad hoc networks. The above mentioned protocol is also used to afford an innovative high competence protocol. To overcome the entire above mentioned dilemma, the author's proposed a modified technique from the base protocol TORA as Stable-TORA in diverse circumstances through NS-2 simulation and the information are estimated [9].

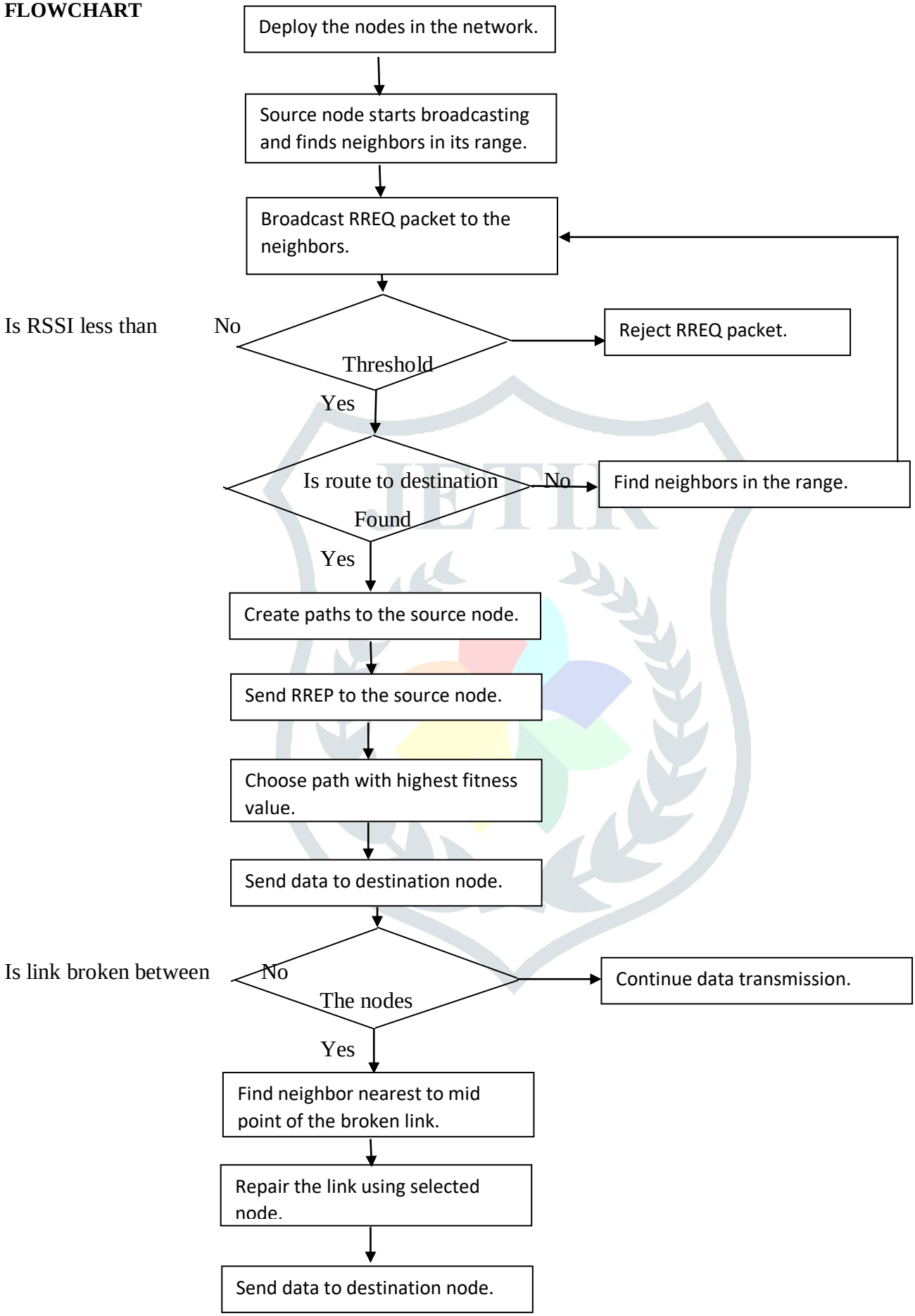
In this study, Vrince Vimal, Madav Nigam, Harvinder Verma proposed Modified Mobility Factor that is premeditated based upon keeping track of movement, hold time and speed of entity. MMF provides the platform to anticipate the duration for which two nodes will remain in communicable range of each other, hence plummeting the problem of link rupture [10]. The authors in [11] evades monotonous usage of similar effectivepath for data transmission, and election of alternativepathbased on energy threshold value is recommended to create more energy proficient network.

III. Proposed Work

To ensure that links formed between the nodes are retained for longer duration of time, leapfrog algorithm will be used in the proposed scheme. The proposed scheme will work in the following way:

- When the source node has some data to forward to destination node, it will broadcast RREQ packets in the communication range.Each node has a fixed range of say 'R' meters; it cannot communicate to any other node beyond this range.
- If the distance between any two nodes is already nearly equal to 'R' meters during the route request phase itself, then it is very likely that if those two nodes are chosen for sending data to destination, the link between them will no longer be available. Thus, sending RREQ packets over such links will lead to unnecessary energy consumption.
- In the proposed scheme, every node will forward RREQ packets to every node in the network only if their RSSI values are more than threshold RSSI value.
- The threshold RSSI will be computed for distance equivalent to 80 percent of communication range.
- If RSSI value for two nodes is less than threshold RSSI, then the node will not take part in forwarding route request packets. This will lead to saving of energy in the network.
- When the request reaches the destination node, it will reply to the source node over various paths.
- The source node will select the paths according to the fitness function defined in the existing scheme.
- To make sure that no extra control packets are sent when the links between two nodes are broken during data transmission, the proposed scheme will use the Leapfrog algorithm to repair the broken links.
- According to this algorithm, if any link between two nodes is broken, then they will communicate with each other through their common neighboring node. Thus, the link will get repaired instantly which will reduce the overhead of forwarding control packets in the network.

FLOWCHART


Deploy the nodes in the network.
Source node starts broadcasting and finds neighbors in its range.
Broadcast RREQ packet to the neighbors.
Is RSSI less than Threshold
No
Reject RREQ packet.
Yes
Is route to destination Found
No
Find neighbors in the range.
Yes
Create paths to the source node.
Send RREP to the source node.
Choose path with highest fitness value.
Send data to destination node.
Is link broken between The nodes
No
Continue data transmission.
Yes
Find neighbor nearest to mid point of the broken link.
Repair the link using selected node.
Send data to destination node.

IV. Results

The proposed LP-AOMDV and FF-AOMDV were both implemented in network simulator 2.35. This is an open source simulator and requires UNIX environment to operate. The network shown in the figures above was created using the following simulation parameters:

Parameter	Value
Channel	Wireless
Mac	802.11
Propagation Model	Two Ray Ground
Energy Model	First order Radio Dissipation
Number of nodes	50
Routing protocol	AOMDV
Queue	Drop Tail
Initial Energy	100 Joules
Antenna	Omni Directional
Network Area	1500*1500 m^2
Traffic Type	CBR
Mobility	0-10 m/s

Table 4.1 Simulation Parameters

The performance of the network was analyzed based on throughput, packet delivery ratio and remaining energy in the network. Their values obtained has been shown in the following graphs:

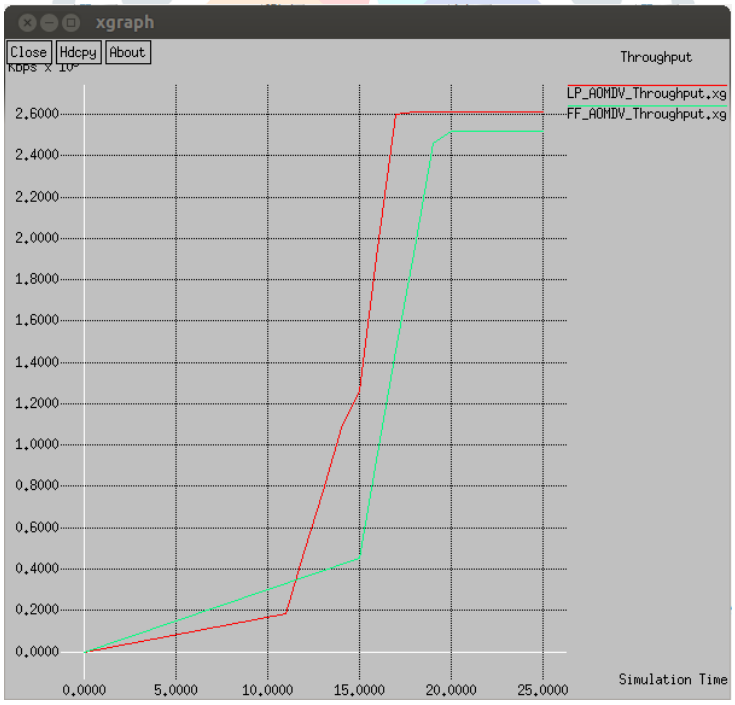


Figure 4.1 Throughput Comparison

The above graphs shows the values of throughput achieved after application of both the schemes in the network. The proposed scheme achieves value of throughput approx. equaling to $2.6*10^3$ Kbps while the existing scheme achieves value of throughput approx. equaling to $2.5*10^3$ Kbps.

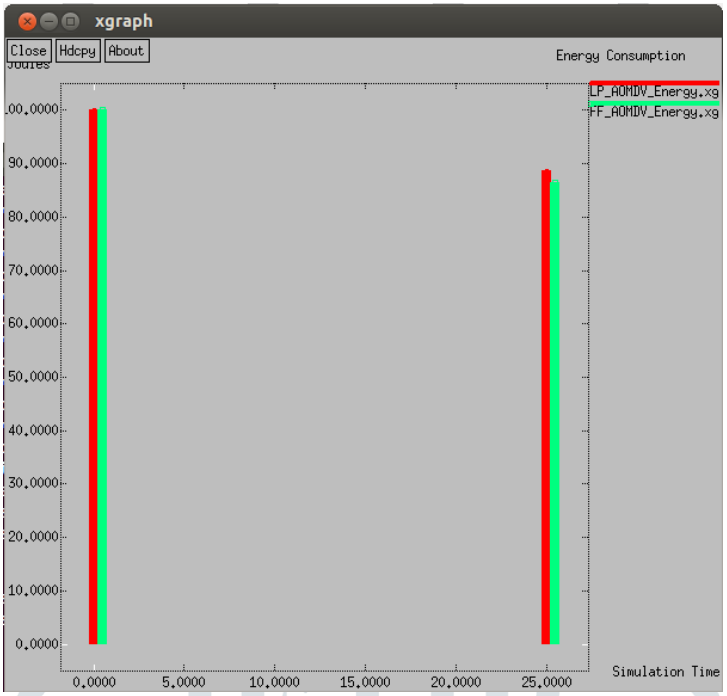


Figure 4.2 Remaining Energy Comparison

The above graph shows the values of remaining energy in the network. Initially node was given average energy of 100 Joules. The proposed scheme consumes energy of 11 Joules and remaining energy is 89 Joules while the existing scheme consumes energy of 13 Joules and remaining energy is 87 Joules. This represents better network lifetime.

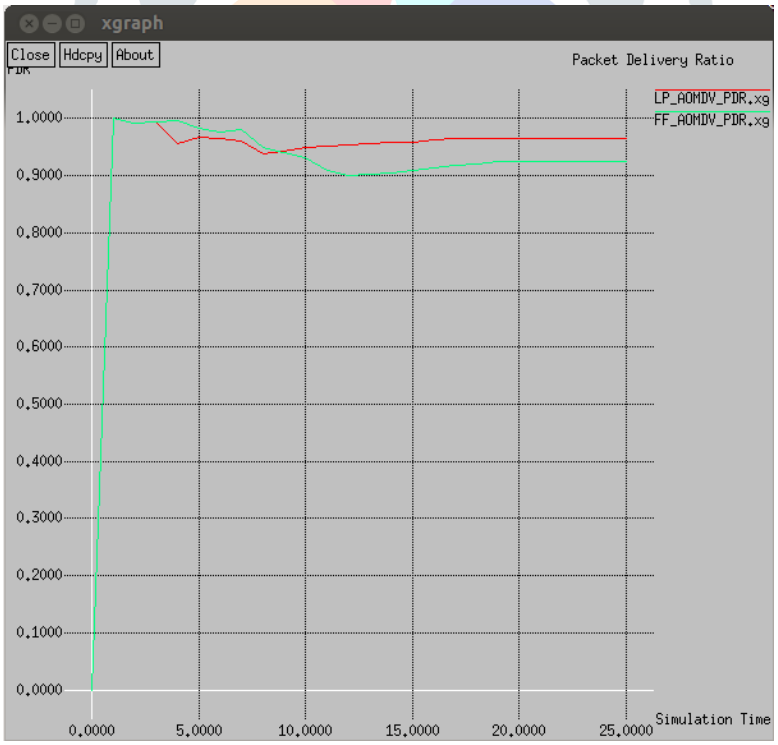


Figure 4.3 PDR Comparison

The above graphs shows the values of PDR in the network. Initially the value of packet delivery ratio shows a downfall, which is because of congestion in the network. The value of PDR for the proposed scheme was 97 percent and for existing scheme the value was 92 percent.

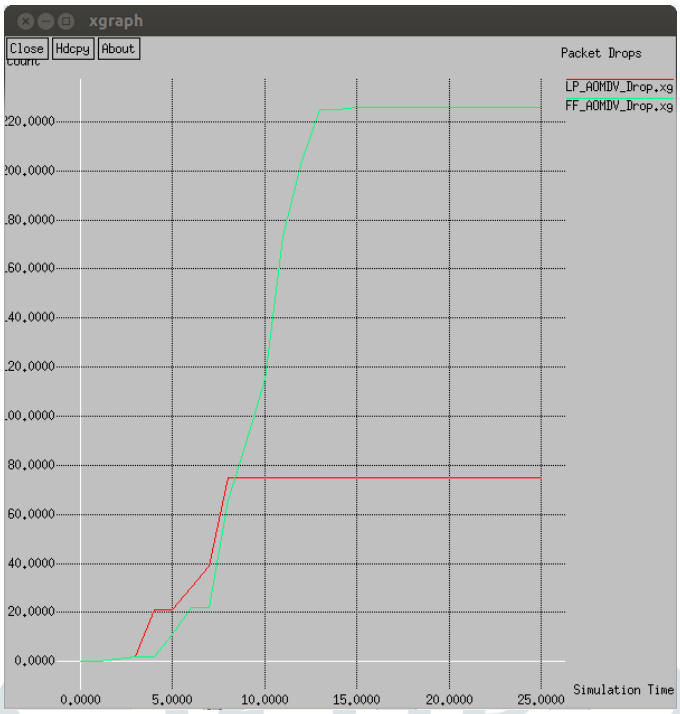


Figure 4.4 Number of Packet Drops Comparison

The above graphs shows the values of number of packets dropped in the network. The value of parameter is high for the existing scheme, around 230, for the proposed scheme the value obtained was around 75. This shows that less packets were dropped in the network when the proposed protocol was applied. This also indicates lesser link breakage in the network.

Table 4.2: Results Comparison

	LP-AOMDV	FF-AOMDV
PDR	0.97	0.92
Throughput	2600 Kbps	2500 Kbps
Remaining Energy	89 Joules	87 Joules
Number of Packet Drops	75	230

IV. Conclusion

The mobile ad hoc networks suffer from issues of link breakage arising out of constantly changing topology. MANETs frequently ache from great packet loss and great link failure [12]. This works aims at solving the issues by making use of modified leapfrog algorithm. The traditional routing protocol such as AOMDV or AODV etc. make use of broadcasting the RERR packets in case of link breakage between the nodes. This broadcasting does repairs the route, but consumes lot of energy of the network. The modified leapfrog algorithm, on the other hand, chooses one common neighbor of the nodes (whose link has been broken) to repair the route. The algorithm is quick and is energy-saver. This was proved by the fact that packet delivery ratio of the network along with throughput has shown better values as compared to the existing scheme. The energy consumption was also found to be less for the proposed scheme Thus, it can be concluded that the network performs well with the proposed scheme than the existing scheme.Recent trends have seen an upsurge in the networks working under Internet of Things environment. In future, this scheme can be used for an application of IOT. Furthermore, the network can be further analyzed under varying mobility scenarios and mobility models.

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