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Modified DSR Protocol using Link Prediction Algorithm for Reliable Ad Hoc Network

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***Abstract*— The MANET(mobile ad hoc network) is a self-configured, self-organized, infrastructure less network and it consists nodes which are mobile in nature and each node can transfer the data packets with each other over either radio or infrared. Some devices like laptop computers and personal digital assistants that can able to communicate with each other directly can be examples of nodes in the adhoc network. In MANET each device is free to move independently in any direction and will change the links to other devices frequently. Each node must forward the data packets until it reach at destination. MANET have variety range of applications like military battle field, disaster area, commercial use, sensor networks, etc. In those places where a temporary network architecture is required in quick interval of time for the transmission of data. The adhoc network uses no centralized authority. So, there will be no collapse in the network mobile nodes moves away from the transmission range. In this type of network nodes must be able to enter/leave the network according to their wish. Since MANET have limited transmission range of nodes so multiple hops are required for the transmission of the data packets. We have analyzed various routing protocols like DSR(Dynamic Source Routing), DSDV(Destination Sequenced Distance Vector), AODV(Ad-hoc On-demand Distance Vector). The DSR protocol have more restrictions as comparison with other routing protocols like DSDV and AODV routing protocols. The link break is one of the major limitation in DSR protocol. The link break occurs simultaneously in DSR protocol because MANET there is a frequent change of topology which cause continuous mobility of nodes results link break so we have proposed a link prediction algorithm from which DSR protocol link break issue can be resolved. The parameters like energy consumption, throughput, end to end delay has been evaluated in Network Simulator 2(NS2) simulation software.**

Keywords—DSR; DSDV; AODV; Link prediction; Topology.

I. INTRODUCTION

MANET(mobile adhoc network) is a type of self-organized, self-configured, infrastructure less network which are connected wirelessly. This network is adhoc because it doesn't depend on a pre-existing infrastructure like access point in wireless network or routers in wired network. An ad hoc network is a self-organizing multi-hop wireless network that does not rely on fixed networks or predefined networking. In this network architecture each nodes is used to forward the data packets to other nodes. So, transmission of data depends on network connectivity and the routing algorithm. Since, MANET can reconfigure itself and frequent change of topology makes mobility of the nodes. Wireless mobile adhoc network are self-configuring, dynamic networks in which nodes are free to move. The power consumption in nodes and frequent link break due to continuous mobility of nodes are major limiting factors in it. Consumption of power is always a topic of interest for researchers because in this type of network nodes has very limited amount of battery. When these networks deployed then battery replacement is not possible and due to continuous mobility of nodes there is link break occurs and in MANET for the reliable data transmission proper link management is the most required parameter. The routing protocol is the most important topic and DSR(Dynamic Source Routing), DSDV(Destination-Sequenced Distance-Vector), AODV(Ad-hoc On-demand Distance Vector) are those protocol which are frequently used in MANET. We have analyzed various protocols like DSR, DSDV, AODV routing protocols [4] and DSR protocol has more restrictions compared with DSDV and AODV routing protocols. The major limitation of DSR protocol is flooding and link break due to frequent change of topology. So, we have proposed an algorithm from which proper link management is done and it make the network architecture of the DSR protocol more reliable and the proposed algorithm will have proper link management to make the network architecture of the DSR protocol more efficient than normal DSR protocol.

II. METHODOLOGY

In MANET(Mobile adhoc network) due to continuous mobility of nodes there is a frequent change in the topology and those mobility of nodes cause link break. In traditional routing algorithms when the link break occurs then new route discovered for the transmission of data packets and that methodology results too much delay and so much costly and ultimately the QoS(Quality of Service) of the network will be

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affected. So, we have proposed a methodology which can able to predict the time at which the link will break.

So, we have proposed a algorithm to predict the time after which the active link will break termed as link prediction algorithm [7]. The link prediction algorithm work on the basis power of the signal received by the nodes data packets and approximation of time and this works by approximating the time at which power of signal strength drops below the threshold power.

When threshold power of the signal strength drops below the threshold level then it indicates that two nodes separating from each other's transmission range. So, when that signal power falls below certain level then it will alert the source that the link might break. So, source either find an alternative route in advance or it will repair the link.

We have taken three consecutive power of signal which is received by data packets received by earlier node are used to predict the link using newton divided difference method.

$$P_r = P_1 + (t_p - t_1)\Delta + (t_p - t_1)(t_p - t_2)\Delta^2 \quad (1)$$

Where,

P_r=Threshold signal strength

tp =Predicted time

Where P_1, P_2, P_3 are signal power strengths for time when packets arrived at t_1, t_2, t_3

$$at_p^2 + bt_p + c \quad (2)$$

$$tp = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (3)$$

The prediction of link break (tp) alerts the source even before the path breaks, allowing the source to restore the path locally or identify an alternate new route in advance.

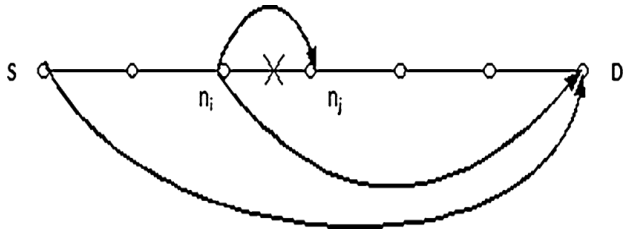

Figure 1. Link prediction used when link break and the routing of data packets done from alternative new path.

In figure it is mentioned that if n_i and n_j link break then source will find an alternative new path to send data packets from source towards destination.

III. SIMULATION AND RESULTS

A. *Energy consumption:*

In modified DSR protocol based on link prediction the energy consumption parameter has been analysed in AODV, DSR and DSDV routing protocols Table 1 shows the analysed results in tabular form and figure 1 shows the results in graphical form.

TABLE 1: ENERGY CONSUMPTION

No. of nodes	Modified DSR	AODV	DSR	DSDV
10	52.1894	65.0119	92.396	81.04
20	52.67	74.7506	97.5785	86.72
30	54.814	78.65	101.4862	92.99
40	55.1219	83.5684	104.3964	96.34
50	56.346	85.4783	109.3	115.04
60	57.7455	89.388	113.22	126.89
70	59.0557	94.2947	116.12	133.2083
80	60.3672	98.2026	121.036	146..56
90	61.6785	104.1157	123.948	163.239
100	63.989	105.256	128.85	175.933

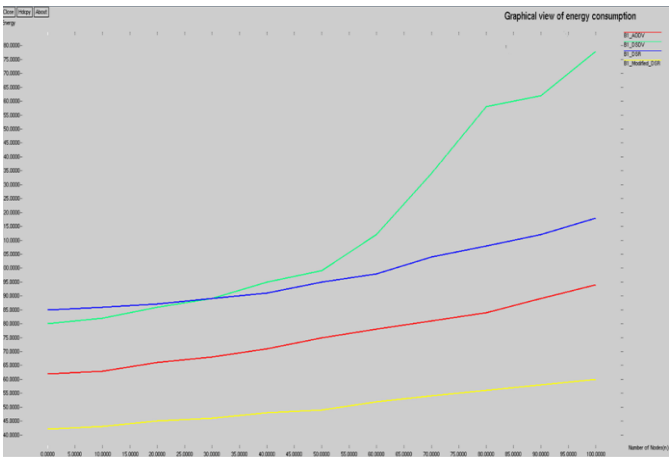

Fig 1: Graphical view of energy consumption

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B. Average Throughput Analysis:

In modified DSR protocol based on link prediction the Average throughput analysis parameter has been analysed in AODV, DSR and DSDV routing protocols Table 2 shows the analysed results in tabular form and figure 2 shows the results in graphical form.

TABLE 2: AVERAGE THROUGHPUT ANALYSIS

No. of nodes	DSDV	Modified DSR	DSR	AODV
10	562.845	673.0719	626.45	650.3058
20	565.571	676.1522	627.47	651.257
30	565.885	676.1989	637.69	655.3657
40	562.4785	675.079	646.672	651.5789
50	566.7384	695.5121	648.85	652.7189
60	588.827	701.1921	647.279	656.9789
70	594.871	704.7455	656.222	655.2856
80	597.311	716.478	657.5322	659.8185
90	597.3956	724.6785	639.251	659.8383
100	597.3659	727.305	632.0588	675.4573

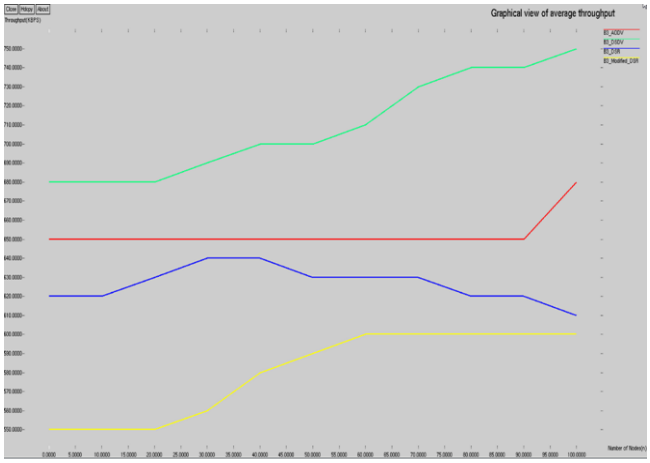

Fig 2: Graphical view of average throughput

C. End to end delay analysis:

In modified DSR protocol based on link prediction the end to end analysis parameter has also been analysed in DSR, AODV and DSDV routing protocols Table 3 shows the analysed results in tabular form and figure 3 shows the results in graphical form.

TABLE 3: END TO END DELAY ANALYSIS

NO.OF NODES	DSR	Modified DSR	AODV	DSDV
10	1.061	0.2347	0.6814	0.6315
20	1.026	0.5511	0.7144	0.6364
30	1.1577	0.6241	0.8744	0.7948
40	1.1617	0.6125	0.911	0.8134
50	1.1786	1.2243	0.96552	0.9574
60	1.667	1.656	1.6828	1.55
70	1.677	2.2271	2.1862	1.559
80	1.7	2.2712	2.2693	1.5964
90	1.77	2.2803	2.647	1.6801
100	1.9743	2.2977	2.892	1.6158

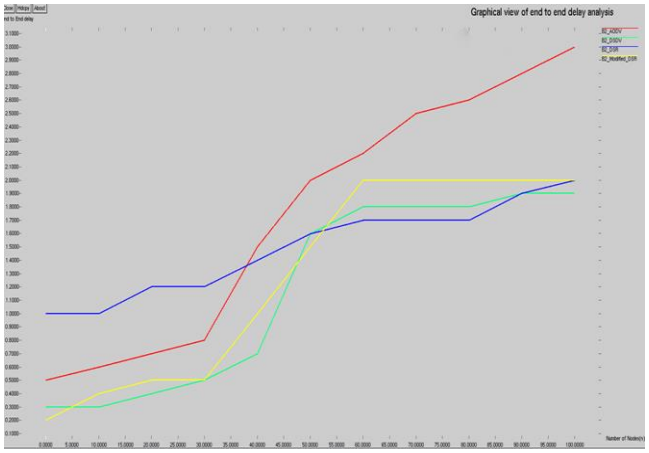

Fig 3: Graphical view of end to end delay analysis

V. CONCLUSION

The modification in normal DSR protocol shows good performance in end to end delay and throughput as we compared with DSR, AODV, DSDV and modified DSR protocols. The simulation result shows that the proposed approach shows better performance in the transmission of data packets from source to destination. The proposed approach link prediction made the link of the network architecture more reliable. A lots of future scope is available for the this model we have discussed here so we can make some more modification in this protocol to make it much more effective. Further these modifications which are discussed can be implemented in other routing protocols like DSDV and AODV protocols for making these routing protocols much more effective.

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