Performance Enhancement of AODV Using Piggyback & Neighbor Stability Technique

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***Abstract*—** In a MANET, no such infrastructure exists and the network topology may dynamically change in an unpredictable manner since nodes are free to move. Then the probability of breaking of links may increase and the interruption will lead to higher route cost and longer delay due to frequent route repair. So mainly discovering the stability of links has become necessary and important. The goal of this paper is to understand the behavior of the basic AODV protocol & then to improve the performance of AODV using Piggyback mechanism & Neighbor stability technique. Also we have comparative study of Basic AODV & Enhanced AODV with some performance metrics using Operating System as Ubuntu 12.04 & network simulator NS2.35 .

Keywords- *Mobile Ad-hoc network, Ad-hoc on-demand distance vector routing protocol, Neighbor change ratio.*

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I. INTRODUCTION

MANETs, are fundamentally different to traditional wired networks as wired networks are assumed to be stationary and static. This imposes different design requirement and constraints on routing protocols for MANETs. Mobility model is considered generally as an important aspect in the area of wireless network, specifically in Ad hoc networks. Node mobility is one of leading factors causing reduced performance in mobile ad hoc networks and limiting network scalability. Selecting stable paths is an effective way to moderate the impact of node mobility.

Hello packets are used to check the connectivity of nodes periodically, help of these beacon messages we can maintain local connectivity information of ad-hoc wireless network so it is very important to keep latest information in routing table. But problem is that to send hello packets periodically which is redundant. To solve this problem here introduce a piggyback mechanism.

This paper presents a new method for electing stable paths. The basic idea is as follows. Each node periodically broadcasts a hello message to detect the local connectivity and maintains its neighbor set. The Neighbor Change Ratio (NCR) of each node is calculated by comparing the difference between node's neighbor sets in different time periods. A new route metric is proposed as the cumulative product of the Neighbor Change Ratios of all the nodes along a path. The destination node selects the path with the largest value of NCR. The selected path has a smaller hop count and less local topology changes. Neither special hardware support nor cross-layer support is needed in the new method. Simulation results using the AODV route protocol show that the new method reduces the long path break probability and improves network performance.
Ad hoc On-Demand Distance Vector (AODV)[5][1] routing is a routing protocol for mobile ad hoc networks and other wireless ad-hoc networks. AODV provides unicast routes to destinations within the ad- hoc network. It uses a hop by hop method for route discovery .It uses destination sequence numbers to ensure loop freedom at all times avoiding problems associated with classical distance vector protocols. AODV is jointly developed by C. Perkins, E.M. Belding-Royer and S. Das. It is an on-demand and distance-vector routing protocol, meaning that a route is established by AODV from a destination only on demand. Routing protocols should select stable paths i.e. which are less likely to break. In this work, we have implemented one such protocol. Different mobility patterns lead to different performance of routing protocols. Kurnal Patel, Tejas Vasavada found that stable AODV routing protocol works better than normal AODV routing protocol under all mobility models having different mobility. Neighbor change ratio [6] in this paper a new simple method for selecting stable paths is proposed. This method uses a Neighbor Change Ratio metric, The resulting NCR-AODV protocol is simulated under various mobility and traffic scenarios. The results show that the NCR-AODV protocol has a lower long path break probability and improved network performance compared to the AODV protocol .or minimize the flooding of Hello packets by using a piggyback technique[3]. To minimize route cost, it is important to find out a route which endures longer lifetime.

II. RESEARCH METHOD

This technique uses a Neighbor Change Ratio mobility metric and does not require any GPS supporting hardware function or cross layer support which is very complex, critical and expensive. The method selects paths which have small hop counts and stable local topologies. An extension to the AODV routing protocol is used as an example of using the Neighbor Change Ratio metric. But the nodes still need to broadcast Hello packets periodically in meanness of forwarding control packets or data packets which have carried the neighbor messages of their neighbors. To resolve the matter, we introduce the piggyback technique & the neighbor stability algorithm in the basic AODV, for enhancing the performance of protocol.

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Proposed System divided of into two part of results. PART I represent the result of basic AODV & DSR comparison. It helps to understand the nature of protocols in related to simulation conditions ie well suited for certain situations. PART II represent the results of AODV & PWAODV comparison which gives us a better route cost and smaller delay. Following Fig 1 shows diagram of proposed system.

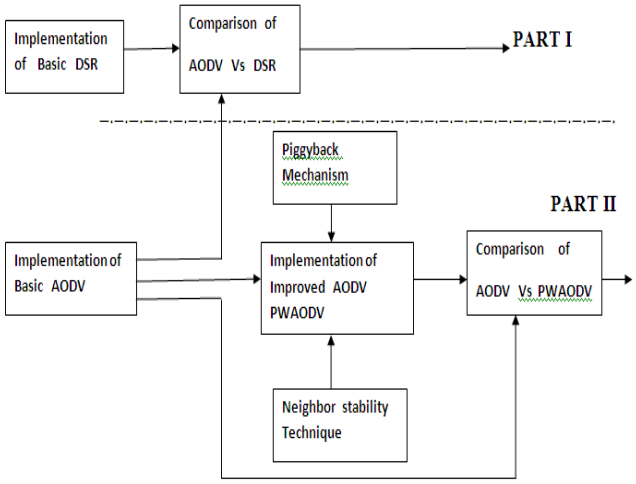

Figure 1. Block Diagram of the proposed work

Block diagram of proposed system consist of several functional blocks as follows,

Implementation of Basic DSR:- Here we configure the basic DSR protocol in certain simulation conditions where same as apply in the basic AODV implementation by using network simulator NS2.

Implementation of Basic AODV:- Here we configure the basic AODV protocol in certain condition where same as apply in the implementation of basic DSR using NS2

Comparison of AODV Vs DSR:- In this block we study the result of protocol comparison which help us to understand behavior of each protocol during following same network & simulation conditions. To achieve well suited protocol under certain condition.

Piggyback Mechanism:- In this functional block we proposed one mechanism for hello packets to minimize the redundancy network due to broadcasting of hello packets in the network.. Hello messages will not need to be broadcasted if a node has transmitted the packets such as control or data packets in a Hello interval. if node has transmitted the control or data packet then don't send Hello packet for Hello interval.

Neighbor Stability technique:- In this functional block we proposed one technique for selecting stable path is an effective way to moderate the impact of node mobility as result of this to achieve a smaller end to end delay.

Implementation of Improved AODV(PWAODV):- After introducing above two techniques into the basic AODV one by one. Then we get the performance enhancement in the basic AODV as lower route cost & smaller delay respectively.

Comparison of AODV Vs PWAODV:- In this Block we study the result protocol comparison which represent the improvement of basic AODV after introducing the new technique in it. Which gives the better performance ie piggyback mechanism and weighted neighbor stability algorithm to achieve better route cost and smaller delay respectively for enhancing the performance of AODV.

III. IMPLEMENTATION

In above proposed system there are two parts. Out of these two first is about basic comparison of AODV & DSR Protocol . In second part we have two important techniques which are as follows Piggyback and Neighbor stability technique.

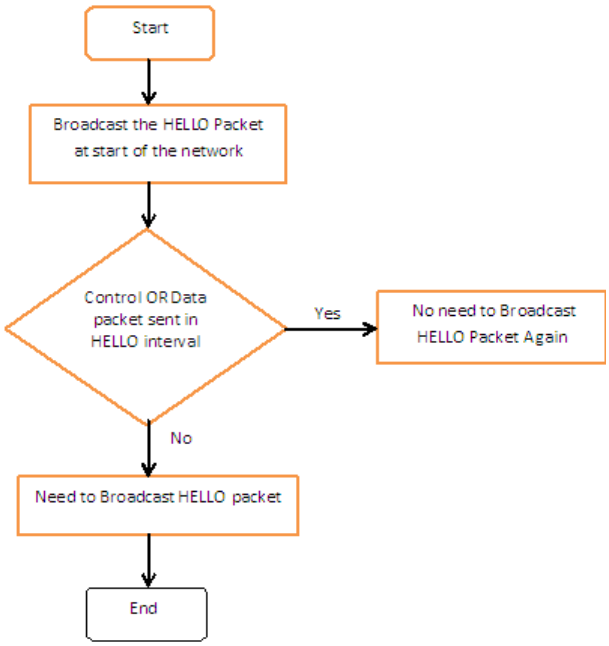

Figure 2. Flow chart of the Piggyback Mechanism.

The idea of piggyback is come into picture by the way that Hello messages will not need to be broadcasted if a node has transmitted the packets such as control or data packets in a Hello interval. In AODV protocol, by using this method, we can reduce the battery consumption that is we can get benefit from lower route cost. Some periodic Hello messages are dismissed when control packets or data packets which include many messages of nodes to its neighbors are transmitted correctly. Really, such redundancy will increase route cost and energy consumption, even bring the weakening of the entire network.

- Hello messages will not need to be broadcasted if a node has transmitted the packets such as control or data packets in a Hello interval
- First send hello packet while starting network .
- If node has transmitted the control or data packet then don't send Hello packet for Hello interval
- Else send hello packet separately.

In order to implement the proposed system, NS 2.35 is used as a tool on Ubuntu 12.04 Linux operating system .

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The Flow chart of the Neighbor stability technique is shown in fig.

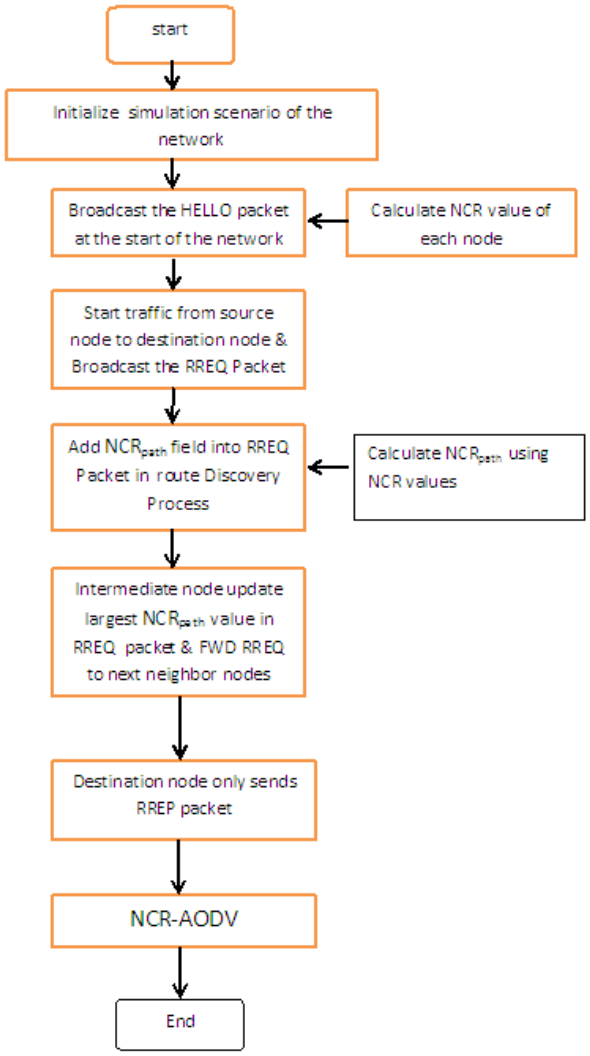

Figure 3. Flowchart of Neighbor stability technique

The basic idea is as follows, Each node periodically broadcasts a hello message to detect the local connectivity and maintains its neighbor set. The destination selects a stable path to forward data. The following two factors are important to decide path stability. A node which has a stable local topology should be selected. If the path is made of nodes with fast changing local topologies, the probability of path breaking will increase. A shorter path should be selected since a long path is more likely to be broken in a dynamic network topology. The Neighbor Change Ratio (NCR) of each node is calculated by comparing the difference between node's neighbor sets in different time periods.

$$NCRi(t) = \frac{|S_{i\_t-T} \cap S_{i\_t}|}{|S_{i\_t-T} \cup S_{i\_t}|} \quad (1)$$

A new route metric is proposed as the cumulative product of the Neighbor Change Ratios of all the nodes along a path.

$$NCRpath = \prod_{i \in path} NCRi(t) \quad (2)$$

The path which has largest value of NCR is selected by destination node. The selected path has a smaller hop count and less local topology changes. The larger the value of neighbor change ratio.

IV. EXPERIMENTATION AND RESULT

A. *Network Simulator—NS2*

NS2 is an open source software, which gives the flexibility of making modification. Here we use NS2.35 version . In NS simulator coding file should be save with .tcl extension on root path .and always run form the command window. Output of the NS2 programs are in two forms first in trace file and second in Animator window. Output data files of NS2 program are called as trace files with .tr extension and also .nam files. We consider most used routing protocol AODV as the example to present the implementation process**.** From above our study to show the procedures of implementing AODV routing protocol.

Elements of NS2

- Create the Event Scheduler [Scheduler clock , Event queue]
- Turn on tracing.[tracing-data files , nam files- Animator files]
- Create Network[fixed nodes , mobile nodes]
- Setup Routing [Unicast & Multicast]
- Create Transport connection.[TCP or UDP connection]
- Create traffic type.[CBR or FTP Application]

B. *Simulation Environment*

For the simulations, with NS-2 network simulator, we will use MAC Layer IEEE 802.11 DCF, Routing protocol – AODV. Assume that 50 nodes with 250m radio transmission range are distributed randomly within an area of 1500m*900m.The mobility model is random waypoint model, with varying different maximum speeds in steps of 5m/s, different pause times and nodes. Traffic type is CBR. Comparing AODV and Enhanced AODV with different performance metrics.

Area	1500m*900m
Node-Placement	Random
Mobility Model	Random Way Point
Simulation Time	25 s,33s
Routing Protocol	AODV,DSR, Improved AODV
Transmission Range	250m
CBR Packet Size	512 bytes

Table 1.1

C. *Simulation Metrics*

- Route cost :-Route cost is defined as the ratio of the total number of bytes of transmitted control packets and the total number of bytes of transmitted data packets.

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Route cost is analyzed with the different maxspeed(m/s) and with different Pause time(s).

- End-to-End Delay:-It refers to the time taken for a data packet to be transmitted from source to destination. The end-to-end delay is analyzed with different maxspeeds(m/s)
- Throughput:- The rate of packets communicated per unit time. The average throughput at a unit time (simulation time in seconds) under varying max speed of nodes. For all the simulated routing protocols

.In this paper described about the comparative study of AODV Vs DSR Protocols. And performance of the Enhanced AODV with AODV according to the simulation metrics as route cost and end-to-end delay. .

1)Installed Operating System Ubuntu 12.04 with NS2.35

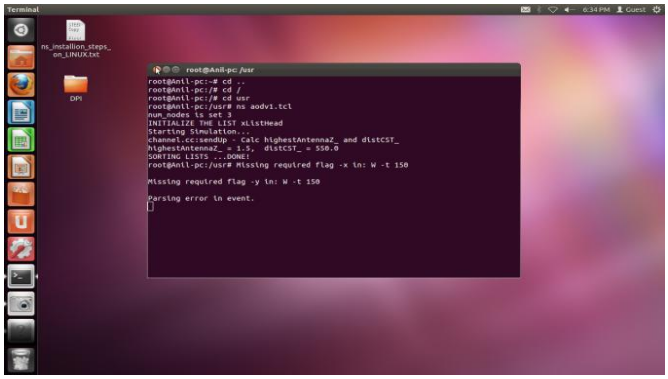

Figure 4.GUI of Ubuntu 12.04 & cammand prompt window

2)TCL Script

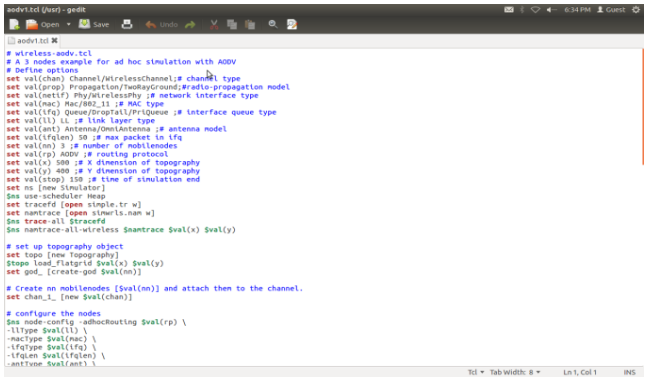

Figure 5 .tcl file

*3)*Data file format –Trace file format & Nam file format& Animation file

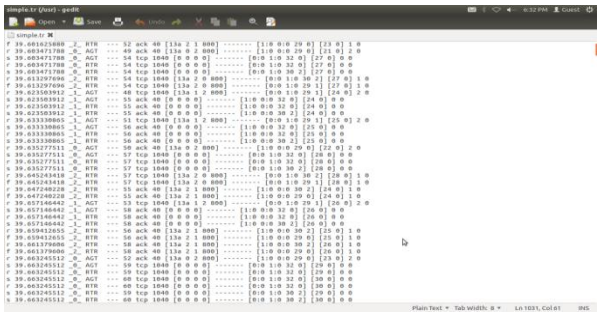

Figure 6: .tr file

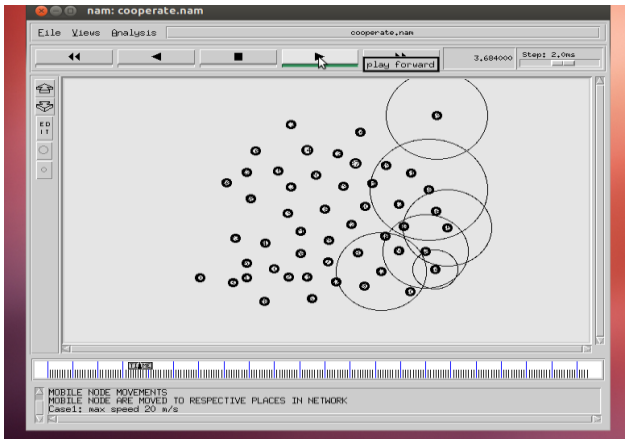

Figure 7: Animation file

D. Simulation Result of Part I [AODV Vs DSR]

Now disccuse about comparative study of AODV & DSR Protocol. Simulations were done varying the speed from (5m/s to 20 m/s) keeping the pause time constant (0 sec). routing protocols as DSR to AODV and then Here comparing basic AODV & DSR protocol In this scenario the Comparison were based on performance metric: Throughput, End to End Delay. To understand the behaviour of each protocol in same simulation conditions.

1) AODV Vs DSR- End to end delay graph of AODV & DSR under same simulation condition.

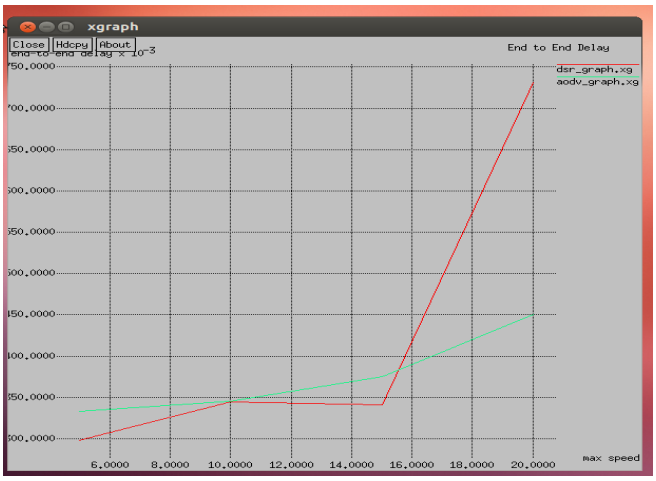

Figure 8.End to End delay

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As it can be seen from the above results , Here In the Graph maxspeed in (m/s) represent the X axis & On Y axis values of the end to end delay. the End to end delay of red line in the graph represent the DSR protocol which is gradually increase delay as speed increases up to 5 m/s to 10 m/s speed. Then from speed 10 m/s to 15 m/s it shows approximately constant but after 15 m/s to 20 m/s Delay of DSR protocol is rapidly increases. Green line represents the AODV protocol. As compare to DSR protocol, End to end delay of AODV is more at the start at 5 m/s and it is slowly increases throughout the graph to 20 m/s. For above simulation condition end to end delay of AODV is much less than the DSR.

2) AODV Vs DSR – Throughput graph of AODV & DSR under same simulation condition.

As it can be seen from the below result from graph, Here In the Graph maxspeed in (m/s) represent the X axis & On Y axis values of the throughput. and red line from the Throughput graph represents throughput value of the DSR it's gradualy increases from 5 m/s to 20 m/s . But Throughput of the DSR is comparatively less than AODV. .Here green line in the graph represents the value of AODV protocol . which is shows more value of throughput than the DSR protocol.

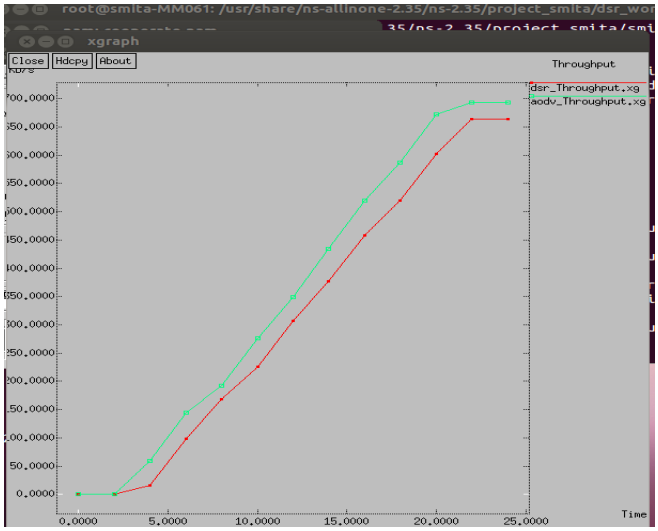

Figure 9- Throughput

E. Simulation Results of Part II [AODV Vs Improved AODV]

Now disccuse about comparative study of AODV & Improved AODV Protocol.Here comparing basic AODV & Improved AODV protocol taking as a end to end delay & throughput & route cost are as performance metrics to understand the performance enhancement of each protocol in same simulation conditions.first fig represent the animation file of Part II .

1) AODV Vs Improved AODV- End to end delay graph of AODV & Improved AODV under same simulation condition.

Fig.10 End to End delay

As it can be seen from the above results , In the Graph maxspeed in (m/s) represent the X axis & On Y axis values of the end to end delay. the End to end delay of red line in the graph represent the Improved AODV[PWAODV] protocol. Here end to end delay of PWAODV is nearly constant from 5m/s to 10 m/s, then it's slowly increases as speed increase up to 15 m/s again end to end delay of improved AODV is slowly increases as speed increases to 20 m/s. Green line represent the end to end delay value of basic AODV .

2) AODV Vs Improved AODV- Graph of Route Cost with same simulation condition.

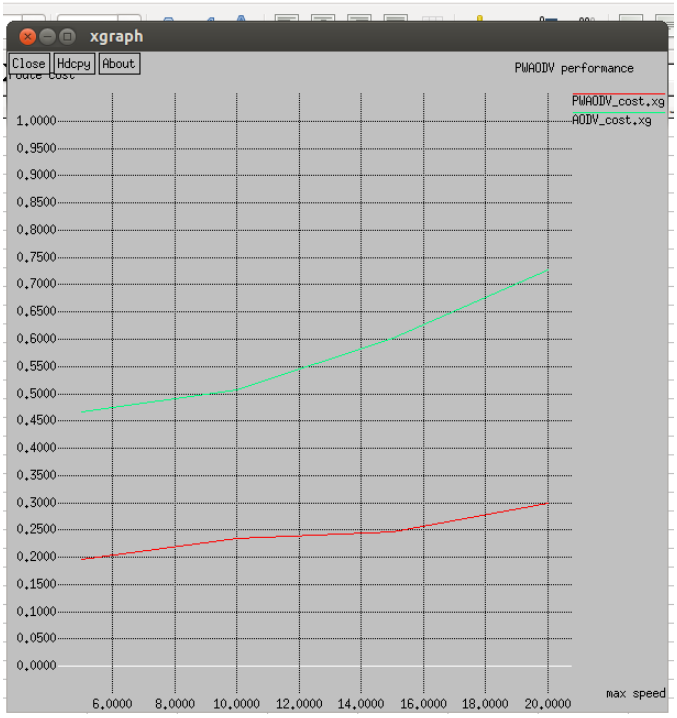

Figure 11- Route Cost

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As it can be seen from the above results , In the Graph maxspeed in (m/s) represent the X axis & On Y axis values of the Route cost. The route cost of red line in the graph represent the Improved AODV[PWAODV] protocol. Nature of the graph is slowly increases as speed increases.Value of the route cost is very less than the Basic AODV which is represent in Green line.

3) Piggyback Mechanism used in Improved AODV

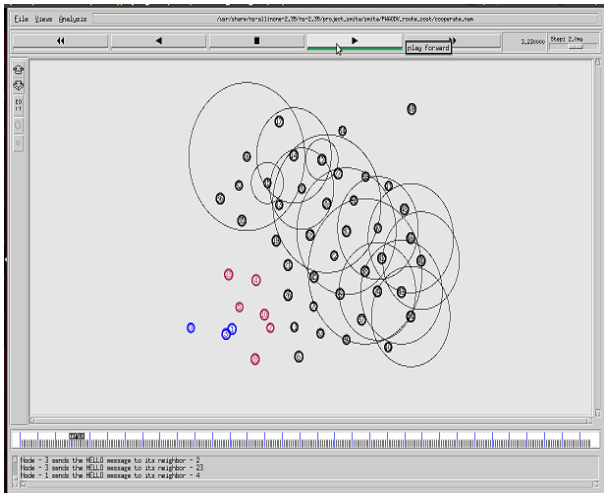

Figure 12- Piggyback Mechanism

The idea of piggyback is come into picture by the way that Hello messages will not need to be broadcasted if a node has transmitted the packets such as control or data packets in a Hello interval. Here in above fig, blue color node represents the hello packet broadcasting nodes which is broadcast the hello packets to it's neighboring node. Red color nodes become red after receiving hello packet from neighboring node.

V. CONCLUSION AND FUTURE SCOPE

From the above results of part I, we studied the nature of the basic protocols like AODV & DSR.

From the above results of part II ,various performance measures we can conclude that we can minimize the overhead due to mobility of nodes that is Selecting stable paths is an effective way to moderate the impact of node mobility. By using neighbor stability technique can minimize value of end to end delay.

Hello packets are used to check the connectivity of nodes periodically. But due to these periodic broadcasting of hello packets redundancy of network increases .To minimize this redundancy in network we introduce piggyback mechanism which is help to reduce in value of route cost.

VI. ACKNOWLEDGEMENT

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