IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 5, May 2021

DOI 10.17148/IJARCCE.2021.105101

Ad Hoc On-Demand Distance Vector (AODV) Routing Protocol for MANET

Ajit Gedam[1], Prathamesh Shinde[2], Anurag Siddhanti[3], Anurag Jarande[4], Alfiyaz Shaikh[5]

Lecturer, Computer Engineering, AISSMS Polytechnic, Pune, Maharashtra, India[1]

Students, Dept. of Computer Engineering, AISSMS Polytechnic, Pune, Maharashtra, India[2]

Students, Dept. of Computer Engineering, AISSMS Polytechnic, Pune, Maharashtra, India[3]

Students, Dept. of Computer Engineering, AISSMS Polytechnic, Pune, Maharashtra, India[4]

Students, Dept. of Computer Engineering, AISSMS Polytechnic, Pune, Maharashtra, India[5]

Abstract: MANET (Mobile Ad hoc Network) is a collection of two or more devices to form a communication network. There are various types of MANET routing protocols for different purposes. In this paper we had implemented AODV (Ad hoc on demand distance vector) and some other routing protocols. comparative analysis of these protocols has done. To find out which one is faster and effective compare to other. All this implementation has done in ubuntu using NS3 simulator.

Keywords: MANET, AODV, NS3, DSR, AD-HOC.

I. INTRODUCTION

Mobile Ad-hoc Network (MANET) is a collection of communication devices or nodes that wish to communicate without any fixed infrastructure and pre-determined organization of available links [1]. MANET is a standalone network it does not need any router to operate it. Ad-hoc has two types routings one is single hop and another one is multi-hop. MANET is a multi-hop type of routing. In MANET there are three types of routing protocol exists first proactive routing protocol in this type each node knows the entire topology of the network. Second reactive routing protocol in this protocol node has no information about topology it just know last and the next node of the node. Third and last protocol is hybrid protocol in hybrid protocol it is hybrid of both proactive and reactive protocol. In hybrid protocol nodes has grouped into zones. If the connection is in the zone then it act as proactive but is the connection is outside the zone the reactive protocol is used. This is how manet works. Ad-hoc on demand distance vector (AODV) routing protocol is a type of MANET routing protocol. AODV is a loop-free routing protocol in ad-hoc networks. AODV uses Bellman-Ford distant vector algorithm, it is mainly suitable for mobile environment. AODV determines the the path for packet to travel when needed by the source. With the help of sequence number AODV maintains the loop free routing.

II. RELATED WORK

The Performance of DSR, AODV (Reactive), DSDV (Proactive) on different parameters like PDF, Average end-toend delay, and Routing Overheads and Packet Loss Their results has evaluated that AODV performed better in dense environment except packet loss. DSR and AODV both performed well. AODV and DSR are proved to be better than DSDV [2]. The authors in compares three routing protocols AODV, DSDV and DSR Protocols, the metrics used for this performance analysis are throughput and normalized routing load. Their assumed scenario shows that DSR shows best performance than AODV and DSDV in terms of Throughput and Normalized Routing Load [2]. This research proposes a development of a network simulations that involves three steps; identifying the required research data, identifying the required software and identifying the parameters that affect the network simulation. For verification purpose, the network simulation is analyzed and evaluated. To develop a network simulation, Network Simulator 3 (NS3) is employed. NS2 software is employed to reduce the range of deviations and data errors while improving the accuracy of the research results [3]. AODV, DSDV, DSR and OLSR protocols in different node numbers in MANET are examined in terms of average end to end delay, throughput, and packet delivery ratio performance metrics. The end-to-end delay of a path is the sum of all the above delays incurred at each link along the path. Packet Delivery Ratio is the ratio of the successful data packets to the destination generated by the CBR source. Meanwhile, throughput is the number of packets that pass through the network in one unit of time in kbps size [3]. All the routing protocol we implemented is doing good performance but the reactive protocols are more effective than other protocols because of there path finding algorithms and path maintenance, path discovery this feature makes reactive protocol more effective than others. AODV in reactive protocol is best in performance and effective.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 5, May 2021

DOI 10.17148/IJARCCE.2021.105101

III. OVERVIEW OF ROUTING PROTOCOLS IN MANET

MANET routing protocols is a types of protocols who doesn't need any centralized tower for establish a connection. Node connects directly to each other. MANET is effective for local areas. There are three types of routing protocol first proactive second reactive and last hybrid protocol.

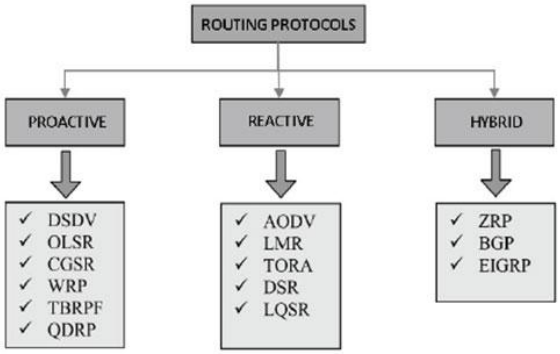

Fig 1. Types of Routing Protocols

A. PROACTIVE ROUTING PROTOCOLS

Proactive routing protocol is a type of routing protocol where each node knowns the entire topology of the network. Every node knows the all latest information required for routing. There are many examples of this such as : Destination Sequenced Distance Vector (DSDV), Fisheye State Routing Protocol (FSR).

- **DSDV(Destination Sequenced Distance Vector)**

DSDV is one of the popular once reactive protocol or on-demand routing protocol. DSDV is used widely it is also known as table-driven routing protocol for MANET. DSDV is depend on number of hops to reach destination node. DSDV protocol is has several
Major characteristics one of these are every node in DSDV protocol has entire topology and other information required for routing

- **Optimized Link State Routing (OLSR)**

OLSR stands for Optimized Link State Routing protocol. In OLSR each node re-broadcasts link state information received from its neighbors. Each node keeps track of information received from other nodes. And that node use received information for determine next hope to each destination. It is proactive and table-driven.

B. REACTIVE ROUTING PROTOCOLS

Reactive routing protocols are on demand routing protocols and the route information continually updates with the latest route topology. It floods a query into the network to obtain the path to destination instead of the source node wants to transmit a packet. There are several examples for Reactive routing protocols such as: Ad-hoc on demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR)[2].

- **AODV (AD-HOC ON DEMAND DISTANCE VECTOR**

AODV does not know the topology of the whole network. It only knows the next node and last node. So when node wants to send packets to destination. Node sends a route request (RREQ) and when the route is discovered destination node sends a route reply (RREP). If destination node is not found it can reinitiate route when route error (RERR) message is received by source node. AODV is a loop free protocol and it avoids count infinity problem by using sequence number.

- **DSR (DYNAMIC SOURCE ROUTING)**

DSR is also reactive or on-demand routing protocol. DSR is designed for reducing bandwidth wasted via the packets in wireless adhoc network. In DSR protocol it does not need any infrastructure or administration , because it is fully self-configure network. The source routing does not need to keep the routing information via the intermediate hops

C. HYBRID ROUTING PROTOCOLSC. HYBRID ROUTING PROTOCOLS

This protocol is a combination of (proactive + reactive) protocols. ZRP (Zone Routing Protocol) have been a classic example in which the allover topology is divided into a zones hierarchy. Proactive routing is used within each zone locally, while reactive routing protocol used beyond the zone. All nodes within r hops radius are considered a zone [2].

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 5, May 2021

DOI 10.17148/IJARCCE.2021.105101

- **Enhanced Interior Gateway Routing Protocol (EIGRP)**

Enhanced Interior Gateway Routing Protocol (EIGRP) is a Cisco proprietary enhanced Distance Vector routing protocol. EIGRP is based on IGRP, hence the configuration is similar. Enhanced Interior Gateway Routing Protocol (EIGRP) is considered as a Hybrid Routing Protocol because EIGRP has characteristics of both Distance Vector and Link State Routing Protocols.

Table 2: Features of Routing Protocols

Features	Reactive	Proactive	Hybrid
Routing Structure	Flat	Flat/Hierarchical	Hierarchical
Route Acquisition	On demand	Table driven	Combination of both
Routing Overhead	Low	High	Medium
Latency	High due to flooding	Low due to routing tables	Inside zone Low outside similar to reactive protocols
Scalability	Not suitable for large networks	Low	Designed for large networks
Routing information	Available when required	Always available	Combination of both
Periodic Updates	Not needed	Yes whenever the topology of the network changes	Yes
Mobility	Route Maintenance	Periodic updates	Combination of both

IV. SIMULATION ENVIORNMENT AND PERFORMANCE PARMETERS

In this section, The environment used for simulate analysis is shown in below table. Figure 2 and figure 3 despite the scenario for AODV protocol.

Table 1:shows the simulation parameters

Parameter Name	Value
Network simulator	NS3, Sumo Traffic Simulator
Network interface type	Physical wireless
Routingprotocol	AODV, AODV-AV
Interface queue type	Priority queue
Queue length	50 packets
Time of simulation end	100 simulation seconds
Number of nodes in topography	20 and 80
Area	81 X 81 and 163 X 163
Node placement	Random
Traffic type	TCP
Radio propagation model	Two Ray Ground

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 5, May 2021

DOI 10.17148/IJARCCE.2021.105101

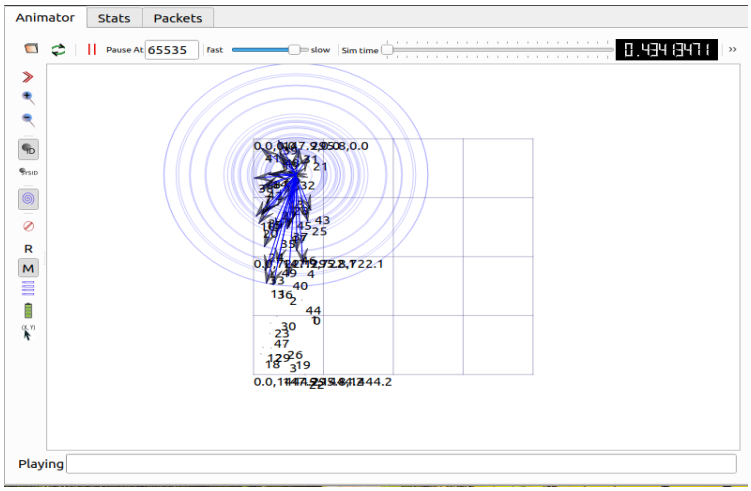

Figure 2 Scenario of Mobile nodes for AODV

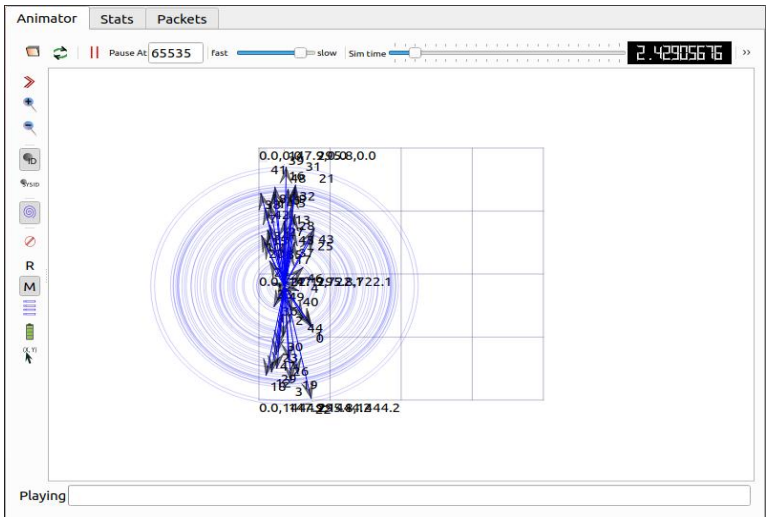

Figure 3 Scenario of Mobile nodes for AODV

B. SIMULATION BASED PERFORMANCE PARAMETERS:

The performance parameters used for the simulation are as follow: Packet delivery ratio, Average throughput, Routing overhead and Average Delay.

Packet Delivery Ratio: - It is defined as the ratio of number packets received by the destination to the number of packets originated by the source. For better performance of a routing protocol, it should be better [16].

Packet loss ratio = (P s − P l) × 100 P s

Average Throughput:- It is defined as the total amount of data a receiver receive from the sender divided by the time it takes for the receiver to get the last packet [17].
Throughput (bits/sec)= sum (number of successful packets)*(average packet_size))/Total Time sent in delivering that amount of data.

Routing Overhead: It is the total number of routing packets transmitted over the network, expressed in bits per second or packets per second. Routing overhead= total no. of packets transmitted over network / packets per sec [2].

Average Delay: A specific packet is transmitting from source to destination and calculates the difference between time of sending and the time of receiving. Delays due to route discovery, propagation or transfer time are included in the delay metric. Delay can be defined as:

Packet Delay = Packet receive time – packet send time

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 5, May 2021

DOI 10.17148/IJARCCE.2021.105101

V. SIMULATION RESULTS AND DISCUSSION

We have implemented AODV, DSDV, DSR, OLSR with number of node. Performance have been analyzed with number of node. Various parameter used for simulation is given in Table 1 and simulated nodes is shown in Figure 2, Figure 3. Features of routing protocol is shown in Table 2.

Packet Delivery Ratio:
Packet delivery ratio versus number of node for AODV, OSLR, DSDV routing protocol has been shown in figure 4. In this experiment we have observed that AODV is better in performance in case of Packet delivery ratio. Number of increases the neighbor density increases hence the value of Packet Delivery Ratio increases for all on demand routing protocols. So, AODV is better in performance among all MANET routing protocol, where DSDV is not good in performanc.

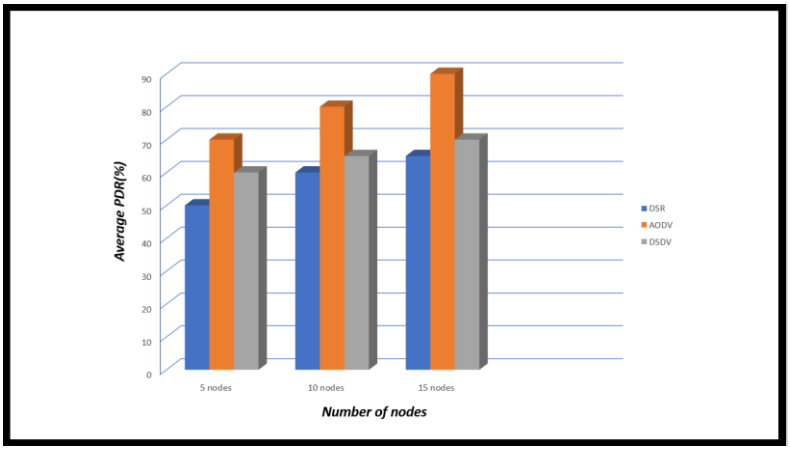

Figure 4: Packet delivery ratio vs. number nodes for Different protocols

Average Throughput:
Average throughput versus number of nodes for AODV, DSDV, OSLR, DSR MANET routing protocol is shown in figure 5. We have seen that AODV is better in performance after DSR because the throughput increase in number of node for all the on demand the routing protocols and it delivers more packets as compare to other routing protocol. So we have observed that AODV has maximum throughput so it is the best protocol compare to other. In this case DSDV is worst in performance.

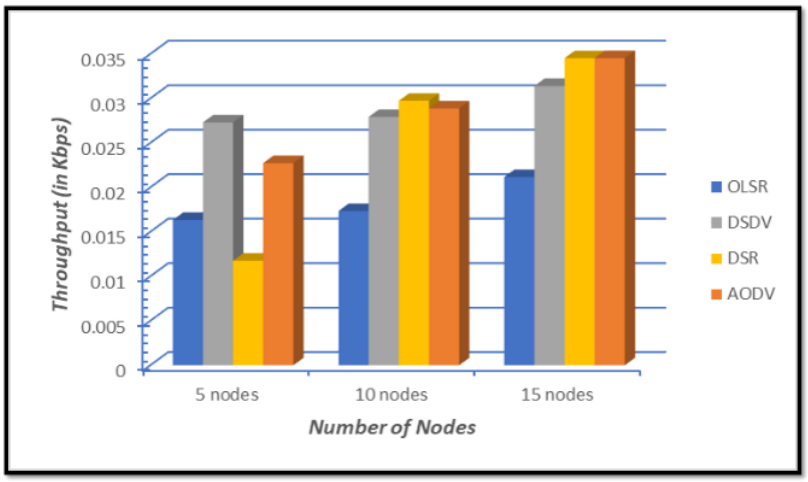

Figure 5 Average Throughput vs. number of nodes for different routing protocols

Average Delay:
The Average Delay versus number of node for OSLR, DSDV, AODV Mobile Ad-hoc Network (MANET) routing protocol. Here we have compared only three OSLR, DSDV, AODV, among these AODV is better in performance. But if we have compared with DSR it would have perform better. Overall in every situation AODV is good.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 5, May 2021

DOI 10.17148/IJARCCE.2021.105101

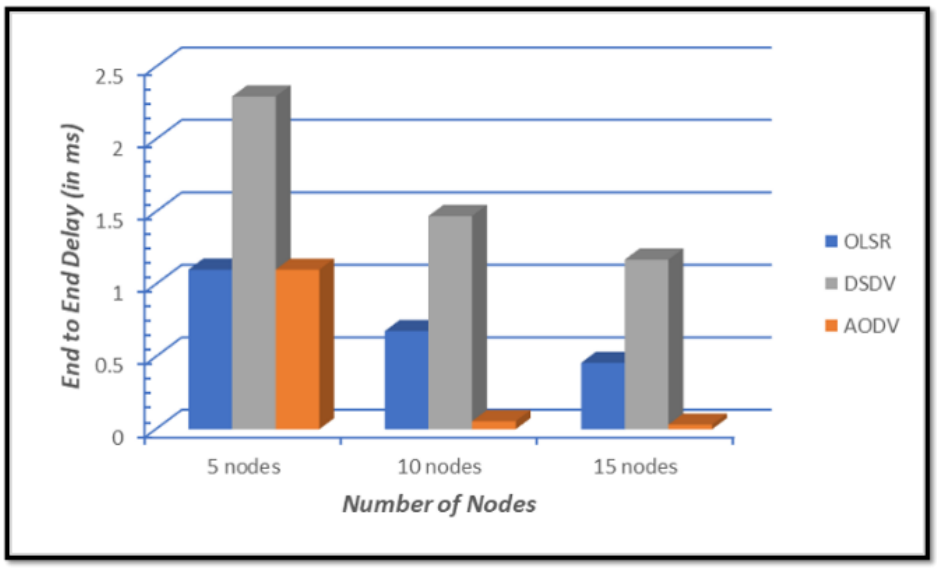

Figure 6 Average Delay vs. number of node for Different protocols

Routing Overhead:

The Routing overhead is total number of packets transmitted over network, we have performed with DSR, AODV, DSDV and the have observed that AODV has the least routing overhead means. AODV is best in performance and the DSR is worst with high routing overhead. So DRS is worst and AODV is best in this case.

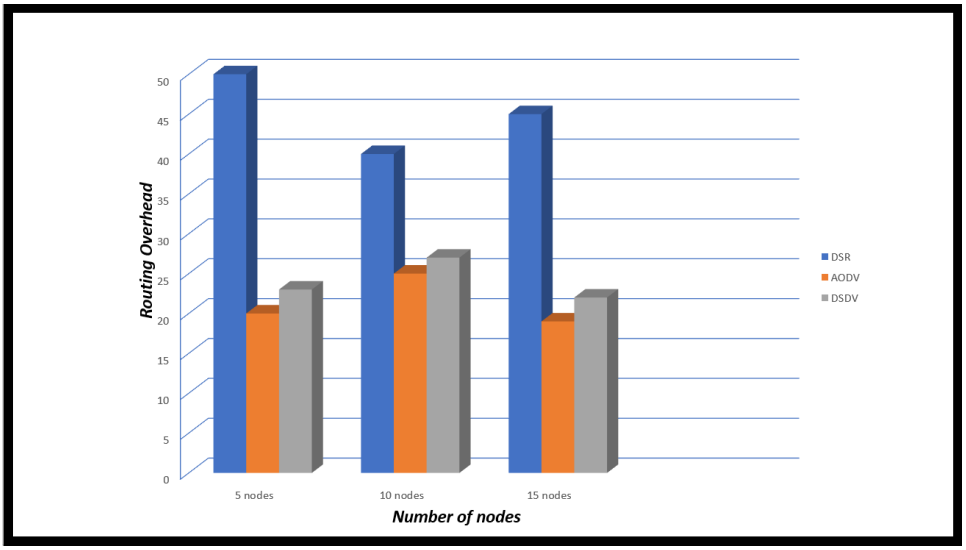

Figure 7 Routing overhead vs. number of node for Different protocol

VI. CONCLUSION

The Research has been conducted to stimulate the performance of the MANET Routing Protocols that is AODV, DSDV, DSR and OSLR based on packet delivery ratio. Also it has been found that overhead are better in case of DSR routing protocol as we increase. The number of nodes and the Packet Delivery Ratio and Average Throughput are better in case of AODV routing protocol with increase in number of nodes and Average Delay.

ACKNOWLEDGMENT

I would like to express my special thanks of gratitude to my teacher (Name of the teacher) as well as our guide Ajit Gedam who gave me the golden opportunity to do this wonderful project on the topic Ad Hoc On-Demand Distance Vector (AODV) Routing Protocol for MANET, which also helped me in doing a lot of Research and i came to know about so many new things I am really thankful to them.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 5, May 2021

DOI 10.17148/IJARCCE.2021.105101

REFERENCES

[1]. Sandhya katiyar. Dr.Rajneesh Gujral Dr.Bhawna Mallick"Comparative Performance Analysis of MANET Routing Protocols in Military Operation Using NS2"
[2]. Divangna Gupta, Rajneesh Kumar Gujral "Simulation of Different Routing Protocols in MANET Using NS2" International Journal of Scientific and Research Publications, Volume 4, Issue 8, August 2014
[3]. Nur Amirah Mohd Saud, Mohamad Asrol Arshad,Alya Geogiana Buja, Ahmad Firdaus Ahmad Fadzil" Mobile Ad-Hoc Network (MANET) Routing Protocols: A Performance Assessment"
[4]. Gunseerat Kaur, Poonam Thakur "Routing Protocols in MANET: An Overview" International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT) 2019
[5]. David B. Johnson, David A. Maltz, and Yih-Chun- Hu, "The Dynamic Source Routing Protocol for Mobile Ad Hoc Networks", in IETF, pp. 1-31, 2004.
[6]. Mr. Rajneesh Gujral, Dr. Anil Kapil "Secure QoS Enabled On-Demand Link-State Multipath Routing in MANETS" Proceeding of BAIP 2010, SPRINGER LNCS-CCIS, Trivandrum, Kerala, India, , pp. 250-257, 2010.
[7]. S.S. Tyagi, R.K. Chauhan "Performance Analysis of Proactive and Reactive Routing Protocols for Ad hoc Networks" International Journal of Computer Applications Vol. 1(14), pp. 31-34, 2010.
[8]. Preeti Gaharwar Mr. Sunil R. Gupta , " Performance Comparison of AODV, DSDV, DSR Routing Protocols in MANET" International Journal of Advanced Research in Computer Science and Software Engineering Vol. 3(4),pp.1059-1063, 2013.
[9]. Sukhpreet Kaur, Chandan Sharma, "An Overview of Mobile Ad hoc Network: Application, Challenges and Comparison of Routing Protocols", IOSR Journal of Computer Engineering (IOSR-JCE) Vol. 11(5) pp. 07-11, 2013.
[10]. Rajneesh Kumar Gujral, Jitender Grover, Anjali, Sanjeev Rana , "Impact of Transmission Range and Mobility on Routing Protocols over Ad-hoc Networks" Rajneesh Kumar Gujral International Conference on Computing Sciences, pp. 201-206, 2012.
[11]. Vishal Polara, Pooja Bhatt "Analyzing Performance of Zone Routing Protocol by Varying Node Density and Transmission Range " International Journal of Computer Science, Information Technologies, Vol. 5 (3), 2014, pp. 2776- 2782, 2010
[12]. C.Siva Ram Murthy and B.S.Manoj "Ad hoc Wireless Network" Architectures and Protocols" , 2004.
[13]. Muazzam Ali Khan Khattak JATIT,"Challenging Ad-hoc Networks under reliable and unreliable Transport wieh variable node density", pp. 309-318, 2005.
[14]. C. E. perkins and E. M. Royer, "Ad Hoc On-demand Distance Vector Routing," In Proceedings of the 2nd IEEE Workshop on Mobile Computing Systems, Application, New Orleans, LA, pp. 90-100. 1999.
[15]. Jorjeta G.Jetcheva and David B. Johson, "A Performance Comparison of Routing Protocols for Ad Hoc Networks," school of computer science, computer On-Demand Multicast science department, Pittsburgh, 2004.
[16]. U. T. Nguyen and X. Xiong, "Rate-adaptive Multicast in Mobile Adhoc Networks," IEEE International Conference on Ad hocand Mobile Computing, Networking and Communications, 2005.