PERFORMANCE EVALUATION OF MULTIPATH REACTIVE ROUTING PROTOCOLS IN MANET

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ABSTRACT

In a mobile ad hoc network (MANET) there is a collection of wireless devices which moving in seemingly adventitious directions and communicating with one another without establishing the real infrastructure. Communicating nodes in a Mobile Ad hoc Network normally seek the help of other intermediate nodes to establish communication channels. Thus, the communication may be via many intermediate nodes from source to destination. Multi-path routing is better one than the single path routing in mobile ad hoc networks, this is because many path routing allows the lay foundation of many path between a single source and single destination node. But in multipath routing, there is a problem of overhead management and transportation performance. So the aim of this work is to design such a wireless system which uses reactive multipath routing protocol who gives better data transportation performance than baseline protocols. Also it improves throughput and packet delivery ratio with reduction in overhead and end to end delay. The proposed approach contains implementation of better routing protocol which provide proper route updates, set require parameters at proper value, generate wireless network which has low error rate and fast packet generation. We used ns-2 to simulate. Simulation results will show better data transportation performance than baseline protocols. Also it will show improvements in throughput and packet delivery ratio with reduction in overhead and end to end delay.

Keyword : *Mobile Ad-Hoc Network1, Routing Protocols2, Multipath Extensions3, DSR4, AODV5, AOMDV6.*

1. INTRODUCTION

A mobile ad hoc network (MANET) is a wireless communication network, where the nodes that are not within the direct transmission range of each other they require some other nodes to forward the data. It can be operate without establishing the infrastructure and support mobile users which are in a network, and it falls under the general scope of multi hop wireless networking. This type of networking paradigm originated from the needs in battlefield communications, emergency operations, search and rescue, disaster relief and in many other operations. Now a day, it has been more used for civilian applications such as community networks. The most of the great deals of research and results have been published since its early days in the 1980s. The newly research challenges in this area include high packet delivery ration with low overhead, end-to-end data transfer, low error rate, link access control, security, and providing support for real-time multimedia streaming.

The network layer has received a much more of attention in the research field in MANETs. As a result, abundant number of routing protocols in this network with different objectives and for various specific needs have been proposed. In fact, the two most important operations at the network layer, those are data forwarding and routing are distinct concepts. Data forwarding relates to how packets are taken from one link and put it on another link. Whereas routing firstly determines which path should a data packet follow from the source node to the destination node. After that it essentially provides the former with control input. As the amount of effort in routing

ad hoc networks, data forwarding, follows the same paradigm as that in Internet Protocol (IP) forwarding in the Internet. IP forwarding was mainly designed for multi hop wired networks, in which one packet transmission can be only received by nodes attached with the same cable. However, in wireless networks, packet is transmitted over a medium. Generally, interference during the packet reception intended for the receiving node had been considered completely negative. Thus having the goal of the research in wireless networking in order to make wireless links as good as wired links.

IN other words, we can say that Mobile Ad Hoc Networks (MANET) A mobile, ad hoc network is a self define system of mobile hosts which are connected by wireless links. There is no fixed infrastructure such as base station. If there is condition that the two hosts are not within radio range, then in that case all message communication between them must pass through one or more intermediate hosts which double as routers. The hosts are free to move around randomly, thus hanging the network topology dynamically. Thus routing protocols must be adaptive and able to maintain routes without changing the network connectivity. Commercial applications are likely where there is a need for ubiquitous communication services without the presence or use of a fixed infrastructure.

2. RELATED WORK

In this paper, a lightweight proactive source routing (PSR) protocol is proposed [1]. As PSR is able to maintain more network topology information than distance vector (DV) routing to facilitate source routing, also with that it has much smaller overhead than the traditional DV-based protocols [e.g., destination-sequenced DV (DSDV)], link state (LS)-based routing [e.g., optimized link state routing (OLSR)], and reactive source routing [e.g., dynamic source routing (DSR)].With the tests using computer simulation in Network Simulator 2 (ns-2) shows that the overhead in PSR is only a fraction of the overhead than that of the baseline protocols, and also a PSR achieves similar or better data transportation performance than these baseline protocols.

This paper discussed about the power consumption aspect of the MANET routing protocols [2]. Here the comparison between the performance of Dynamic Source Routing (DSR) and Ad hoc On-Demand Distance Vector (AODV) routing protocols with respect to average energy consumption and also with routing energy consumption are explained thoroughly. After that, an evaluation of how exactly the varying metrics in diverse scenarios affect the power consumption in these two protocols is discussed. A simulation model using Network Simulator 2 (NS2) with different mobility and traffic models are used to study their energy consumption. Lastly, an evaluation of these routing protocols based on energy consumption is presented.

This Paper proposed that, mobile ad-hoc network (MANET) as an energy constraint multi-hop network and with the nodes having routing capability with limited battery power [3]. In any network, establishing a correct and efficient route is an important design issue. Above that a more challenging goal is to provide an energy efficient multi-hop route between sources to destination. So, the routing protocols must establish an energy-efficient route between source-destination pair by considering the energy consumption and residual energy of the nodes. The trust based routing mechanism is one of the best forms of a co-operation among nodes for establishing an energy-efficient route between source-destination pair. Firstly by introducing an energy consumption model to calculate the energy-factor of the nodes and after that propose a trust based protocol for energy-efficient routing. Here a trust module is adopted to track the value of routing matrices. A simulation result shows that the proposed protocol reduces delay, routing overhead, and increases the packet delivery ratio with the less energy consumption as compared to AODV and DSR.

This paper proposed an Energy Conscious routing protocol by modifying one Dynamic Source Routing (DSR) protocol which is not concerned about power consumption [4]. This Energy conscious DSR (ECDSR) uses the basic concept of traditional DSR and imposes it's two importance characteristics as Energy saving and Energy Survival in DSR, this will enhances the life time of the network and also increases the overall performance of the networks. Here the proposed protocol is validated through ns-2.34 and evaluated the performance of the networks

taking the consideration of few energy metrics and found that the proposed method ECDSR outperforms DSR in the performance analysis.

This paper addresses energy conservation which is one of the important factor in Energy Constraint Mobile ad-hoc Networks (MANETs) and also tried to reduce routing overhead in order to efficient functioning of the network [5]. Here by comparing two different protocols with respect to energy conservation and routing overhead. The proposed work is in two modules named Node Energy Aware Methodology which consist conditional Min-Max Battery Cost Routing Algorithm (CMM-BCR) and Destination Estimation Module which consist Distance Routing Effect Algorithm for Mobility (DREAM). Both of these modules together are applied over Dynamic Source Routing protocol (DSR) which is On-Demand Routing protocol and over Destination Sequence Distance Vector Routing Protocol (DSDV) which is a Table driven routing protocol. Simulation shows that this energy scheme used with DSR provides better result than DSDV. As energy efficiency is of main factor in ad-hoc networks so main aim is to know which among these two protocols is good in energy conservation and increases network lifetime by reducing overhead. Here used NS-2 to simulate 50 nodes**.**

This paper proposed the optimized routing protocol for multi-interface multi-channel wireless mesh networks (MIMC-WMNs) [6]. The MIMC-WMNs using original AODV (Ad hoc On-demand Distance Vector) routing protocol which is defined in IEEE 802.11s standard can cause the several problems so will degraded the safety, efficiency, reliability of network. Therefore, to overcome this problem, OM-AODV (Optimized MIMC AODV) protocol is proposed which includes the multi-target PREQ mechanism, the predictive PREQ algorithm, and the PREQ sender assignment algorithm. In addition to that, several performance metrics of the proposed routing protocol will be analysed when it applied to the MIMC-WMNs. Also, the routing protocol will be evaluated by several experiments in outdoor test bed with real mesh routers which are implemented.

3. PROTOCOL OVERVIEW

3.1 Dynamic Source Routing (DSR):-

DSR is a specially proposed efficient routing protocol which is to be used in multi-hop mobile Ad hoc networks. It has two phases, one is Route Discovery and other one is Route Maintenance. These two phases help nodes to find out and maintain the perfect source routes to destinations. The Source Routing is a loop-free routing in which the intermediate nodes do not need any routing information and allows nodes to cache the routing information for the further use. In DSR, each node controls each packet for source route information and later forward it based on this routing information. When the routing information is not found in the packet, it will provide the source routing by knowing the route. When the destination is not known, in that case node caches the packet and finds the routing information to the destination by sending route queries to all nearby nodes. Lastly, it sends the Route acknowledgment back to the source.

3.2 Ad-hoc On-Demand Distance Vector Routing (AODV):-

AODV is also a one of the reactive routing protocol which discovers the routing path whenever needed with the help of route discovery mechanism. It uses traditional routing tables in that table there is a one entry per destination. AODV can relies on its routing table entries to propagate an RREP (Route Reply) back to the source without using source routing and also to route data packets to the destination. By using the sequence numbers AODV can maintain freshness of routing information at each destination to determine and also to prevent routing loops. These sequence numbers are carried out by all routing packets. A timer-based state in each node is maintained by AODV, and these states are utilized for individual routing table entries, while the older unused entries are removed from the table. For each routing table entry predecessor node sets are maintained, which shows the neighboring nodes sets which is to be using that entry to route packets. When the next-hop link breaks these nodes are notified with RERR (Route Error) packets. Again these packets are forwarded by each predecessor node to its

predecessors, by erasing all routes effectively using the broken link. In AODV, routing error propagation can be visualized as a tree in which a node at the point of failure is a root and all sources using the failed link as the leaves. The advantages of AODV are, as information of only active routes are maintained so less memory space is required, which results in increasing the performance. This protocol is not scalable and also it does not perform well in large networks and does not support asymmetric links.

3.3 Ad-hoc On-demand Multi path Distance Vector Routing (AOMDV):-

Ad-hoc On-demand Multi path Distance Vector Routing (AOMDV) protocol is also a reactive routing protocol and for computing multiple loop-free and link disjoint paths it is an extension to AODV. A list of the next-hops along with the corresponding hop counts is maintained by the routing entry for each destination. The same sequence number is carried by all the next hops. This can useful in keeping track of a route. A node maintains the advertised hop count, which is defined as the maximum hop count for all the paths for each destination, which is useful for sending route advertisements of the destination. A node defines an alternate path to the destination for each duplicate received route advertisement. By accepting alternative paths to destination loop freedom is assured for a node if it has a less hop count than the advertised hop count for that destination. For the same sequence number the advertised hop count does not change as the maximum hop count is used. The next-hop list and the advertised hop count are reinitialized when a route advertisement is received for a destination with the greater sequence number. Node-disjoint or link-disjoint routes can be finding out by using the AOMDV. In order to find out node-disjoint routes, each node does not instantly reject duplicate RREQs. Source defines a node-disjoint path with a different neighbour arriving by each RREQs. As nodes cannot be broadcast duplicate RREQs, so any two RREQs arriving at an intermediate node with a different neighbour of the source could not have traversed the same node. The destination replies to duplicate RREQs in order to get multiple link-disjoint routes, the destination only replies to RREQs arriving with unique neighbours. The RREPs follow the reverse paths after the first hop, which are node disjoint and thus link-disjoint. Each RREP takes a different reverse path to the source to ensure link disjointness, but the trajectories of each RREP may intersect at an intermediate node. The main advantage of AOMDV is that while still selecting disjoint paths it allows intermediate nodes to reply to RREQs. During route discovery due to increased flooding AOMDV has more message overheads and the destination replies to the multiple RREQs whose results are in longer overhead since it is a multipath routing protocol.

4. DESIGNING OF A 100 NODE ADHOC NETWORK

First we design wireless network of randomly distributed 100 mobile nodes network and simulation is done to observe the performance metric parameters of the network on NS 2.34. We evaluate the performance of Wi-Fi (IEEE 802.11p) for MANET architectures. Throughput is a measure of the amount of data that can be transmitted in a given amount of time measured in kilobits per second (kbps) or Megabits per second (Mbps). The experimental results are graphically presented on time based plots, Figure: shows the snap shots for 100 nodes.

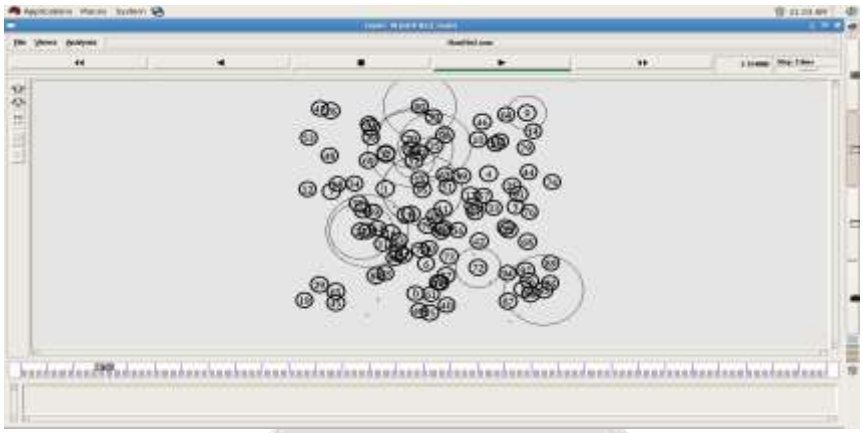

Figure 4.1 Snap Shot for 100 nodes

In above figure 4.1 numbers of nodes are denoted by small circles and we allow it to simulate the designed network. During simulation nodes are intercommunicate with each other and data packet get transfer from source to destination as the data packet transferred there may be packet drop which cause of data packet loss. Here small black dots present data transferred and big black dot represent the packet drop.

5. SIMULATION AND EVALUATION

According to Shannon, simulation is the process of creating a model of a real system and conducting experiments with this system model for the purpose of learning the behavior of the system or evaluating various strategies for the operation of the system. With the different nature of computer networks, we thus actually deal with an energetic model of a real dynamic system.

5.1Simulation tool:-

NS-2 is an open-source event-driven simulator designed especially for research in computer communication networks. Since its inception in 1989, NS-2 has always gained tremendous interest from industry, Academia and various government and private organization. Having been investigation and enhancement for years to investigate network model observe results generated by NS-2.

5.2 Performance Evaluation:-

Implementation of wireless ad-hoc networks in the real world is quite hard one. Hence, the preferred alternative is to use some simulation software which can show the real-life scenarios. Though it is difficult to reproduce all the real life factors such as humidity, wind and human behavior in the scenarios generated, most of the characteristics can be programmed into the scenario.

5.3 Performance Evaluation Metrics:-

By comparing the performance of AODV and AOMDV according to the following performance metrics.

5.3.1 Packet delivery ratio:-

It can be defined as, the ratio of data packets delivered to the destinations to those generated by the constant bit rate.

5.3.2 Average End-to-End delay of data packets:-

This includes all the possible delays caused by buffering during route discovery, queuing at the interface queue, retransmission delays at the MAC and propagation and transfer times.

5.3.3 Routing Overhead:-

Simply it is the total number of routing packets transmitted during the simulation. For packets sent over multiple hops, each transmission of the packet (each hop) counts as one transmission

Table -5.1: Simulation Scenario

Description	Scenario
Simulator	NS-2.34
MAC Type	802.11p
Simulation Time	30sec
Channel Type	Wireless Channel
Routing Protocol	AOMDV
Antenna Type	Omni Directional
Simulation Area	1500m*1500m
Traffic Type	CBR, UDP
Radio Propagation Model	Two Ray Ground
Interface Queue Length	100
Interface Queue Type	Drop Tail / Primary Queue
Number Of Nodes	100
Interval	0.35 Sec

The simulation scenarios of path of forwarding data from source to destination on AOMDV protocol. As the of nodes changes their performances are also changes and its effect on overall network performance**.** All the metrics parameters are allow to run on network simulator version 2.34.

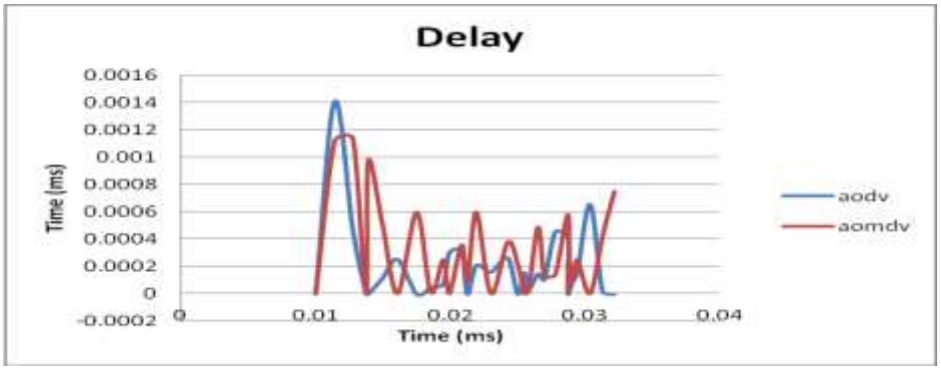

Fig.5.1 Comparative Graph of an avg. Delay Vs Time

Figure 5.1 shows the comparative graph of an average delay for AODV and AOMDV. From this it can be clearly seen that, AOMDV has less delay as compared to AODV.

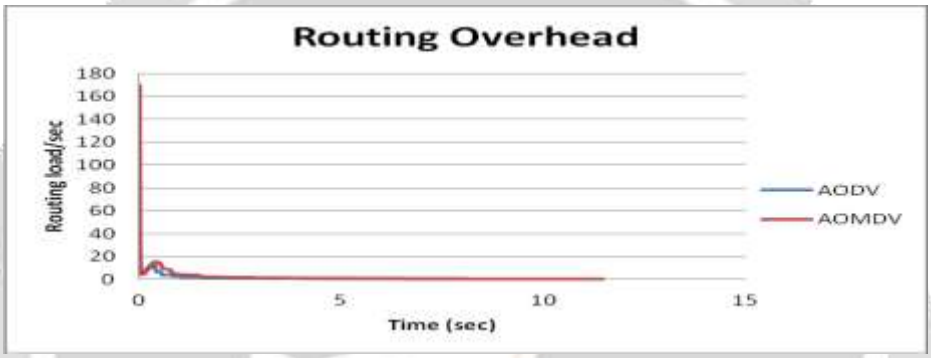

Fig.5.2 Comparative Graph of an avg. Routing Overhead Vs Time

Figure 5.2 shows the comparative graph of an average routing overload for AODV and AOMDV. From this it can be clearly seen that, AODV has less delay as compared to AOMDV, as it is a multipath reactive routing protocol.

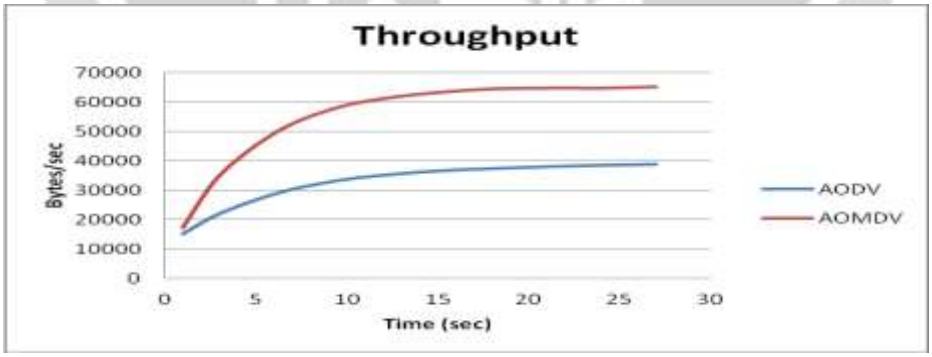

Fig.5.3 Comparative Graph of an avg. Throughput Vs Time

Figure.5.3 shows the comparative graph of an average throughput for AODV and AOMDV. From this it can be clearly seen that, AOMDV has more throughput as compared to AODV.

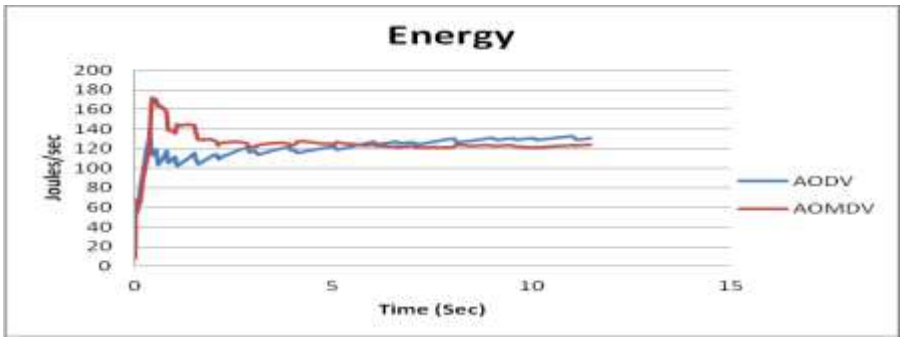

Fig.5.4 Comparative Graph of an avg. Energy Vs Time

Figure.5.4 shows the comparative graph of an average energy for AODV and AOMDV. From this it can be clearly seen that, AOMDV requires more energy as compared to AODV.

Table 5.2: Evaluated Parameters

Parameters	**AODV**	**AOMDV**
Delay	0.463367 ms	0.384915 ms
Throughput	32481.51 bytes/sec	54359.70 bytes/sec
Routing Overhead	0.923443 Routing load/sec	0.968636 Routing load/sec
PDR	98.072239 %	96.651599 %
Energy	127.132939 J/sec	132.507772 J/sec

Table 5.2: Shows the Different Evaluated Parameters of AODV and AOMDV for 100 mobile nodes.

"Table 5.2" shows the different evaluated parameters for AODV and AOMDV. As the of nodes changes their performances are also changes and its effect on overall network performance**.** All the metrics parameters are allow to run on network simulator version 2.34.

6. SUMMARY AND CONCLUSION

6.1 SUMMARY

In this paper the performance of reactive routing protocols is evaluated using 100 nodes network in NS2.34. Pure reactive protocols including AOMDV, AODV perform better than proactive protocols in mobile Ad hoc network. AODV and AOMDV have different routing mechanisms. However, AODV have a same on-demand behavior. AODV applies routing tables with one route for each destination. As AODV is efficient with some mobility scenarios by eliminating source routing overhead of the protocol. But in AODV, discovery route requires more overhead and actually is more expensive protocol. AOMDV outperforms AODV due to its own ability to

search for alternate routes when a current link breaks down. AOMDV incurs more routing overheads while flooding the network and packet delays due to its alternate route discovery mechanism, but it is much more efficient when it comes to packet delivery for the same reason. So, we can say that when network load tolerance is of no consequence, AOMDV is a better on-demand routing protocol than AODV since it provides better statistics for packet delivery and number of packets dropped.

6.2 CONCLUSION

In this paper work presented focuses on improvised AOMDV protocol and to relate that with the some specific application like emergency services. In our work we tried to analyze the major problem with AODV and to overcome that with AOMDV protocol. Here we have chosen to improve the existing protocol with some of the parameters which have been taken into consideration while selecting desired path from source to destination. In case of any emergency with minimize delay, packet loss ratio and maximize throughput, packet delivery ratios. Also this greatly reduces the routing overhead and discovery processes thus increases the network capacity. the performance evaluation of multipath routing protocols in MANET is carried out using a network simulator scenarios. The protocols simulated were AODV and AOMDV. From the results, it can be seen that end to end delay of AOMDV is less than the AODV delay. But it suffers with regard to normalized routing overhead. Also the throughput of AOMDV is more than the throughput in AODV. Thus, study concludes that AOMDV is better suited for high data rate applications with more reliability.

6.3 FUTURE SCOPE

More research and developmental effort is required for improvement of network and traffic simulators. This promising technique has made it possible to explore and model complex simulation scenarios, but as of now this technique is far from perfect.

- Different hybrid routing protocols will be implemented.
- UDP will be replaced by TCP.
- Network size will be increased.
- Power Reduction algorithm will be implemented.

References

[1] Zehua Wang, *Student Member, IEEE*, Yuanzhu Chen, *Member, IEEE*, and Cheng Li, *Senior Member, IEEE,"* PSR: A Lightweight Proactive Source Routing Protocol For Mobile Ad Hoc Networks,", IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 63, NO. 2, FEBRUARY 2014. 0018-9545.

[2] Mehdi Barati I, Kayvan Atefi, Farshad Khosravi and Yashar Azab Dafial," Performance Evaluation of Energy Consumption for AODV and DSR Routing Protocols in MANET", 2012 International Conference on Computer & Information Science (ICCIS), 978-1-4673-1938-6/12.

[3] Sajal Sarkar, *Student Member, IEEE* and Raja Datta, *Senior Member, IEEE*," A Trust Based Protocol for Energy-Efficient Routing in Self-Organized MANETs",978-1-4673-2272-0/12.

[4] Baisakh, Nileshkumar R Patel, Shishir Kumar," Energy Conscious DSR in MANET", 2012 2nd IEEE International Conference on Parallel, Distributed and Grid Computing, 978-1-4673-2925-5/12.

[5] Sheetal Sisodia, Sandeep Raghwanshi," *Performance Evaluation of a Table Driven and On- Demand Routing Protocol in Energy Constraint MANETs",*2013 International Conference on Computer Communication and Informatics (ICCCI -2013), Jan. 04 – 06, 2013, Coimbatore, INDIA,978-1-4673-2907-1/13.

[6] Won-Suk Kim and Sang-Hwa Chung," Design of Optimized AODV Routing Protocol for Multi-Interface Multi-Channel Wireless Mesh Networks'' 2013 IEEE 27th International Conference on Advanced Information Networking and Applications, 1550-445X/13, DOI 10.1109/AINA.2013.25

[7] Bhavna Sharma , Shaila Chugh , Vismay Jain," *Energy Efficient Load Balancing Approach to Improve AOMDV Routing in MANET",* 2014 Fourth International Conference on Communication Systems and Network Technologies, 978-1-4799-3070-8/14 © 2014 IEEE DOI 10.1109/CSNT.2014.247.

[8] R.Balakrishna, U.Rajeswar Rao , N.Geethanjali , "Performance issues on AODV and AOMDV for MANETS", R.Balakrishna et al. / (IJCSIT) International Journal of Computer Science and Information

Technologies, Vol. 1 (2) , 2010, 38-43.

[9] Geetha G and Dr.N.J.R.Muniraj, "A Multipath Routing based Energy Efficient Scheme for MANET, Proceedings of International Conference on Optical Imaging Sensor and Security, Coimbatore, Tamil Nadu, India, July 2-3, 2013.

[10] Bharti Kukreja, Sanjeev Kambhra," Performance Comparison of Routing Protocols in MANET", IJCSNS International Journal of Computer Science and Network Security, VOL.14 No.8, August 2014.

[11] Yashashree A. Jakhade , Nitin R. Gavai , "Comparative Study of AODV, DSR and AOMDV Routing Protocols in MANET ", *International Journal of Advanced Research in Computer and Communication Engineering ,Vol. 4, Issue 10, October 2015* .

[12] Rahul Deshmukh, Jitendra Rai," Performance Based Comparativeanalysis of AODV & AOMDV Protocols Under Energy Constrain'', International Journal of Engineering and Innovative Technology (IJEIT) ,Volume 3, Issue 8, February 2014.

[13] P. Jammulaiah, Dr.P. Chenna Reddy,'' Simulation and Comparison of AOMDV, AODV and DSR in Manets", International Journal of Networks and Systems Volume 2, No.6, October - November 2013.