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# Performance enhancement of MANETs by employing Multipath Routing Protocol

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**Abstract:-**A mobile ad hoc network (MANET) is a continuously self-configuring, infrastructure-less network of mobile devices connected without wires. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. AODV (Ad-Hoc On-Demand Distance Vector) is a reactive routing protocol for mobile Ad- Hoc networks (MANETs) and other wireless ad-hoc networks. Reactive means that it establishes a route to a destination only on demand. Due to combination of many topology change and heterogeneous type, it is really challenging in MANETs to efficiently route data from source to destination without failure. Proposed algorithm is based on AODV routing algorithm and it is compared with AOMDV, AODVM, and IZM-DSR algorithms which are multi-path routing algorithms based on AODV and DSR.

**Keywords:** *MANETs, Nodes, AODV, AOMDV, Multipath routing*.

## I. INTRODUCTION

A MANET is a type of ad hoc network that can change locations and configure itself on the fly. Because MANETs are mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission. Some MANETs are restricted to a local area of wireless devices (such as a group of laptop computers), while others may be connected to the Internet. For example, A VANET (Vehicular Ad Hoc Network), is a type of MANET that allows vehicles to communicate with roadside equipment. While the vehicles may not have a direct Internet connection, the wireless roadside equipment may be connected to the Internet, allowing data from the vehicles to be sent over the Internet. The vehicle data may be used to measure traffic conditions or keep track of trucking fleets. Because of the dynamic nature of MANETs, they are typically not very secure, so it is important to be cautious what data is sent over a MANET.

The ability to transport, or route, data from a source to a destination is a fundamental ability all communication networks must have. Delay and disruption-tolerant networks (DTNs), are characterized by their lack of connectivity, resulting in a lack of instantaneous end-to-end paths. In these challenging environments, popular ad hoc routing protocols such as Ad hoc On-Demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR) fail to establish routes. This is due to these protocols trying to first establish a complete route and then, after the route has been established, forward the actual data. The major restrictions of the AODV, DSR and OLSR protocols raise from the reality that they can work and find a route only if there is an end-to-end path between source and destination.

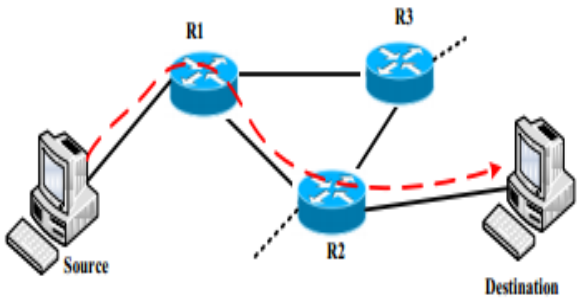



Fig: Traditional Routing protocol systems

However, when instantaneous end-to-end paths are difficult or impossible to establish, routing protocols must take to a "store and forward" approach, where data is incrementally moved and stored throughout the network in hopes that it will eventually reach its destination. The eventual goal of the DTN technology is to

transmit the data packets from source to destination without ruining the integrity of the data bundle while making use of any "opportunistic" transmission mediums it may discover. Therefore, an additional name for DTN's is Opportunistic Networks."The basic principle of an multipath routing protocol is to provide for load balancing in the network. The source node broadcasts the route request packets to the destination node in search of optimal path. Upon receiving the route reply the source node selects more than path possible path to the destination. This provides the network with the load balancing. While in single path routing protocol, the nodes in the path tend to get over-utilized over a period of time. Whereas in multiple path scenario that work to route the data to the destination gets distributed on more than path. This also tends to conserve the energy of the nodes. The basic routing protocol in mobile ad hoc network which provides for multiple paths is AOMDV. With an effort to conserve more energy of the network and hence increase its lifetime, energy efficient AOMDV, (E-AOMDV) has also been proposed. This routing protocol takes energy of the nodes into account while forming the multiple paths between the sources to destination node.

## II. RELATED WORK

Deepti Singh, et al. discussed various challenges are faced in routing in MANETs. Different routing protocols based on flat topology and hierarchical topologies, have been evaluated for better performance of mobile ad-hoc networks, in terms of delay, throughput, load balancing and congestion control. This paper focuses multipath transmission capability and load balancing, to get efficient routing for heavy load traffic. Different issues of multipath routing, like route discovery, energy consumption, load balancing and security issues are discussed in this paper and performance of different multipath routing protocols is compared on the basis of these issues and, Quality of Service parameter is also taken into account. Bhavna Sharma, et al. [5] proposed a new protocol EAOMDV. Existing Multipath routing protocol has provided the concept of load balancing but had not considered the energy. The proposed E-AOMDV i.e. Energy Efficient AOMDV have taken both parameters energy and load balancing into consideration. The selection of next hop is depended upon its energy level and load balancing among its neighbors. The load from each node i.e. data sent through selected node is calculated. The performance of proposed E-AOMDV is compared with AOMDV on the basis of different performance metrics like Packet delivery ratio, Average end-to-end latency, Routing packet overhead, and Throughput, using NS-2.31 as simulation environment. The proposed scheme has shown better performance over existing protocol. E- AOMDV helped in distributing the load properly and in reducing energy consumption. Priyanaka Bansal, et al. proposed a new multipath protocol called Improved AOMDV (IAOMDV), an extension over AOMDV. IAOMDV has provided enhancement in the security by avoiding black hole attacks and DDOS attacks using P.G.P model. For the simulation results NS2 simulator has been used. In the simulation results it has shown that the packet delivery fraction and throughput for the IAOMDV are effective as compared to AOMDV. The routing overhead on case of IAOMDV has been found lesser as compared to AOMDV. It has been found that reason for the better performance of IAOMDV over AOMDV is the implementation of security and load balancing. ArchanaShukla, Sanjay Sharma, proposed AOMDV with queue length estimation technique. The proposed technique has helped in reducing congestion by choosing non congested routes to send RREQ and data packets and if the route has turn out congested then it helped in choosing alternate path with the higher hop count. AOMDV routing protocol for the identification of possibly multiple node-disjoint path between the given source and the destination, has been presented. It has found that the performance of the proposed AOMDV is better than AOMDV in terms of different performance metrics like throughput, packet delivery ratio, end-to-end delay etc. Deeptanoy Ghosh, Poonam Thakur, in [8] discussed different on demand routing techniques with their advantages and disadvantages. This paper discusses the need and specialty of routing protocols and the routing challenges in MANET. The different on-demand (reactive) protocols like DSR, AODV, TORA, ABR, DYMO, LMR, LAR, SSA, CBRP, RDMAR, MSR, AOMDV, ARA are studied and compared with their pros and cons, in this paper. And it has found that all these reactive protocols have their own advantages and disadvantages depending upon the situation of the network. HassanaliNasehi, et al. proposed algorithm for improving energy efficiency for AODV protocol and then a comparison between AOMDV, AODVM and IZM-DSR multipath routing algorithms has been made, based on AODV and DSR. Multipath routing algorithms in MANET send information to destination through different directions simultaneously to reduce end to end delay but the traffic sent in these cases affect the adjacent paths and which increases delay. The proposed algorithm in this paper tries to discover distinct paths, using Omni-directional antennas, to send information simultaneously from source to destination. The algorithm proposed is based on AODV routing algorithm, which is presented as ZD- AOMDV and then it is compared with AOMDV, AODVM and IZMDSR using the GLOMOSIM as simulator. These routing algorithms are compared on the basis of different parameters such as Packet delivery Ratio, End-to-End delay, Routing Overhead, Number of Dead Nodes and Energy Consumption in different scenarios. In the results it has been found that proposed algorithm shows improvement in energy consumption, end-to-end delay and in packet delivery ratio but it has higher routing overheads than AOMDV and AODVM routing algorithms.K.Syed Ali Fathima, et al. [16]

proposed a protocol that is achieved by using ACO algorithm to optimize routing paths, providing an effective multi-path data transmission to obtain reliable communications in the case of node faults. The aim of the paper is to maintain network life time in maximum, while data transmission is achieved efficiently. The paper evaluates the performance of ant base algorithm and AODV routing protocol in terms of Packet Delivery Ratio, Average end-to end delay and Normalized Routing Load and concludes that overall performance of ant based algorithm is better than AODV in terms of throughput.Mina VajedKhiavi, ShahramJamali, evaluated the performances of AODV and AOMDV using ns2 simulator. In the randomly changing network topology, the design of the robust routing algorithm can adapt the dynamic topology, is one of the main challenge in mobile ad hoc network. This paper has compared AODV and AOMDV protocols for MANETs. AODV is the unipath routing protocol and AOMDV is the multipath extension of AODV. These two protocols have been compared using ns2 simulator by varying the number of nodes, pause time and traffic rate. The different parameters on the basis of which AODV and AOMDV had been evaluated are: packet delivery ratio, network life time, system life time and end-to-end delay.AlpeshChauhan, Prof. B.V. Buddhdev, proposed different techniques for improved energy function in case of AOMDV. In mobile communication networks, the wireless devices are portable and battery powered, so they have to work in extreme energy constrains. So energy efficiency is the one of the major issues in the mobile networks. This paper has proposed various techniques to help in improving the energy function, such as Minimum Battery Cost Routing (MBCR), Min-Max Battery Cost Routing (MMBCR), Minimum Total Transmission Power Routing (MTPR), Conditional Min-Max Battery Cost Routing (CMMBCR), Min-Max Residual Energy in AOMDV (MMREAOMDV).

## III. ROUTING IN MANETS

Routing protocols facilitate distinguished mechanisms to create and maintain the routing tables of the nodes of the network and discover a route between all nodes of the network. There should be enough versatility in routing protocols to adapt to any type of topology to permit arriving at any remote host in any network. A vast research account exists for the development of routing protocols in MANETs. The development and improvement of the protocols is dependent on the particular application demands and the architecture of the network. However, there are a few elements that ought to be contemplated when creating routing protocols for MANETs. The protocol should take care of self-configuration, energy efficiency, delay and so forth.

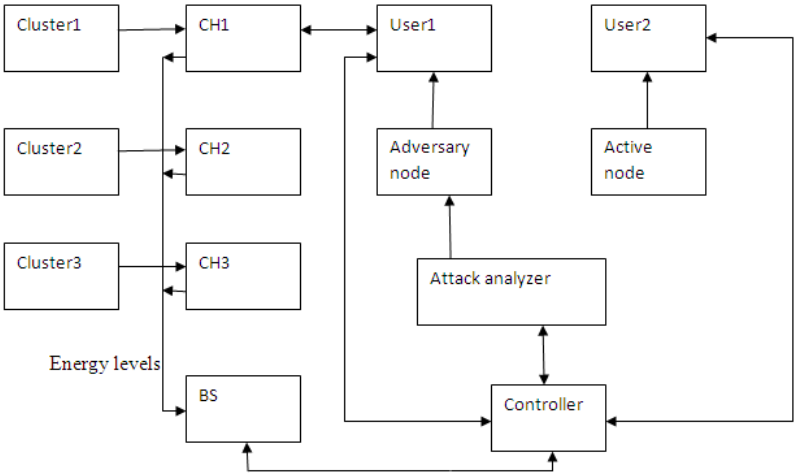
## IV. MULTIPATH ROUTING PROTOCOL

Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV) protocol is a denotation to the AODV protocol for computing multiple loop-free and link disjoint paths. There can be multiple next hops for the same destination with same sequence number. This helps in keeping track of a route. An advertised hop count is maintained for each destination by node. Advertised hop count is the maximum hop count for particular destination. Each duplicate route advertisement received by a node defines an alternate path to the destination. Loop freedom is assured for a node by advertised hop counts. Alternative paths are only considered if they have less hop count than advertised hop count. Because the maximum hop count is used, the advertised hop count therefore does not change for the same sequence number. When a route advertisement is received for a destination with a greater sequence number, the next-hop list and the advertised hop count are reinitialized.AOMDV can be used to find node-disjoint or link-disjoint routes. To find node-disjoint routes, each node does not immediately reject duplicate RREQs. Each RREQs arriving via a different neighbor of the source defines a node-disjoint path. This is because nodes cannot be broadcast duplicate RREQs, so any two RREQs arriving at an intermediate node via a different neighbor of the source could not have traversed the same node. In an attempt to get multiple link-disjoint routes, the destination replies to duplicate RREQs, the destination only replies to RREQs which arrives via unique neighbors. After the first hop, the RREPs follow the reverse paths, which are node disjoint and thus link-disjoint. The trajectories of each RREP may intersect at an intermediate node, but each takes a different reverse path to the source to ensure link disjointness. The advantage of using AOMDV is that it allows intermediate nodes to reply to RREQs, while still selecting disjoint paths. But, AOMDV has more message overheads during route discovery due to increased flooding and since it is a multipath routing protocol, the destination replies to the multiple RREQs those results are in longer overhead.

## V. ENERGY EFFICIENT AOMDV

E-AOMDV [5] routing protocol is an improved version of AOMDV protocol. AOMDV protocol works on multipath but do not take into consideration the energy of the nodes and the amount of traffic sent through the different paths. E-AOMDV includes energy conservation, shortest path and load balancing. In AOMDV, due to imbalanced distribution of load, the nodes with less energy may die soon because they are heavily used in forwarding packets. This leads to imbalanced energy consumption. In E-AOMDV, while selecting one route from multiple routes, energy left at neighbor node is considered and for this each node in the network reports its energy level to its neighbor. In multipath selection, all the next hops from available path are taken in account along with their normalized energy levels and the hop with maximum energy is chosen. Depending upon the

energy level of the nodes the load is being distributed. E-AOMDV helps in reducing energy consumption and increase in energy utilization.




## VI. PROPOSED WORK

Each sensor in the network becomes a clusterhead (CH) with probability *p* and advertises itself as a clusterhead to the sensors within its radio range. We call these clusterheads the volunteer clusterheads. This advertisement is forwarded to all the sensors that are no more than 'k' hops away from the clusterhead. Any sensor that receives such advertisements and is not itself a clusterhead joins the cluster of the closest cluster head. Any sensor that is neither a clusterhead nor has joined any cluster itself becomes a cluster head; we call these clusterheads the forced clusterheads. Because we have limited the advertisement forwarding to *'k'* hops, if a sensor does not receive a CH advertisement within time duration *'t'* it can infer that it is not within*k'* hops of any volunteer clusterhead and hence become a forced clusterhead. Moreover, since all the sensors within a cluster are at most *k* hops away from the cluster-head, the clusterhead can transmit the aggregated information to the processing center after every *t* units of time. This limit on the number of hops thus allows the cluster-heads to schedule their transmissions. Note that this is a distributed algorithm and does not demand clock synchronization between the sensors. The energy used in the network for the information gathered by the sensors to reach the processing center will depend on the parameters *p* and *k* of our algorithm. Since the objective of our work is to organize the sensors in clusters to minimize this energy consumption, we need to find the values of the parameters *p* and *k* of our algorithm that would ensure minimization of energy consumption.

### Algorithm:

Step1: first elects level1 cluster heads and level2 cluster heads
Step2: each sensor node decides to become level-1 cluster head with certain probability p1
Step3: prolong the information as cluster head to sensor nodes within range
Step4: this information forwarded to all sensor nodes within the k1 hops of the advertising CH
Step5: each sensor receives an advertisement joins the cluster of the closest level-1 CH
Step6: the remaining sensor nodes become forced level-1 CH's
Step7: level-1 CH's then elect themselves as level-2 CHs with a certain probability p2
Step8: broadcast their decision of becoming a level-2
Step9: this decision forwarded to all sensor nodes with k2 hops
Step10: the level-1 CHs that receive the advertisements from level-2 CHs joins the cluster of the closest level-2 CH
Step11: all other level-1 CHs become forced level-2 CHs
Cluster heads at 3,4…..are chosen in similar way…with probability of p3,p4,…respectively to generate a hierarchy of CHs.

a) The sensors in the wireless sensor network are distributed as per a homogeneous spatial Poisson process of intensity 'λ' in 2-dimensional space.
b) All sensors transmit at the same power level and hence have the same radio range r.
c) Data exchanged between two communicating sensors not within each other's' radio range is forwarded by other sensors.
d) A distance of 'd 'between any sensor and its cluster head is equivalent to (d/r)hops.
e) Each sensor uses 1 unit of energy to transmit or receive 1 unit of data.

f) A routing infrastructure is in place; hence, when a sensor communicates data to another sensor, only the sensors on the routing path forward the data.

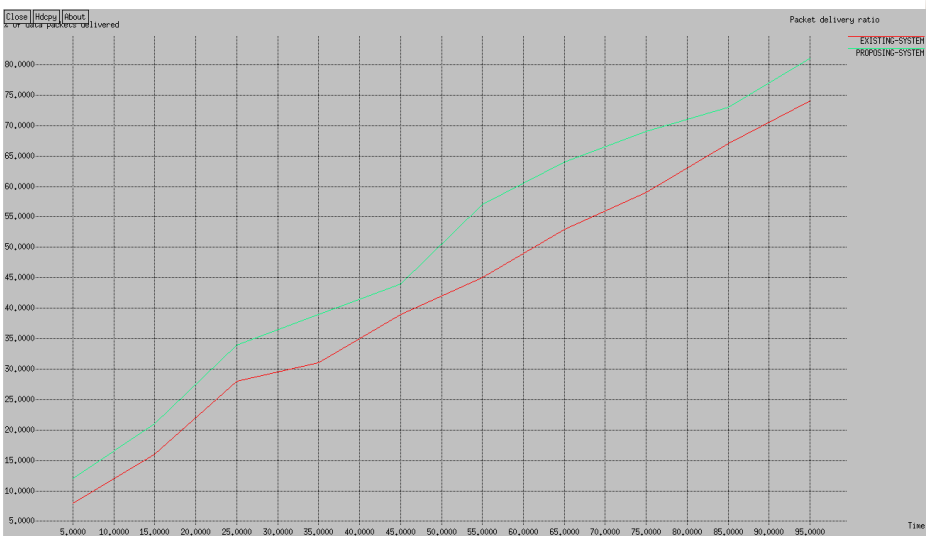
g) The communication environment is contention-and error free hence, sensors do not have to retransmit any data. Proposed system:

1) Energy efficient hierarchical clustering mechanism used
2) Routing information maintained properly
3) Energy calculates individual node using mechanism
4) Secure communication providing

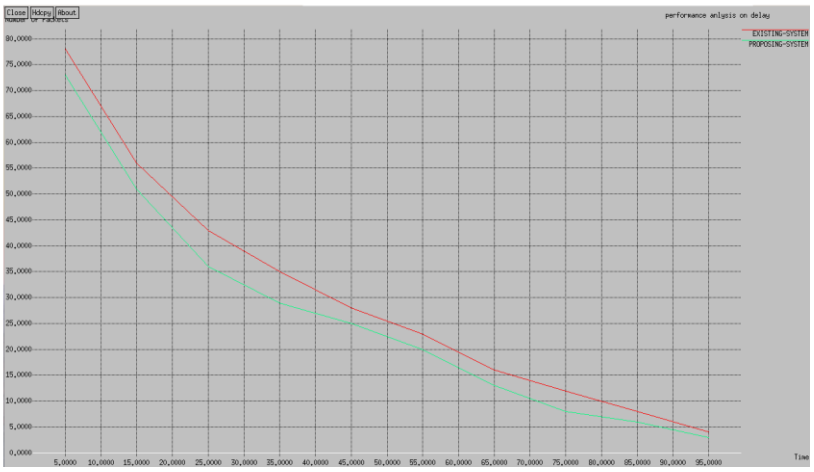
Advantages:

1) Energy consumption low
2) Distance calculation easy
3) Network performance more
4) Routes are maintained properly for communication
5) Fake messages stopping to base station

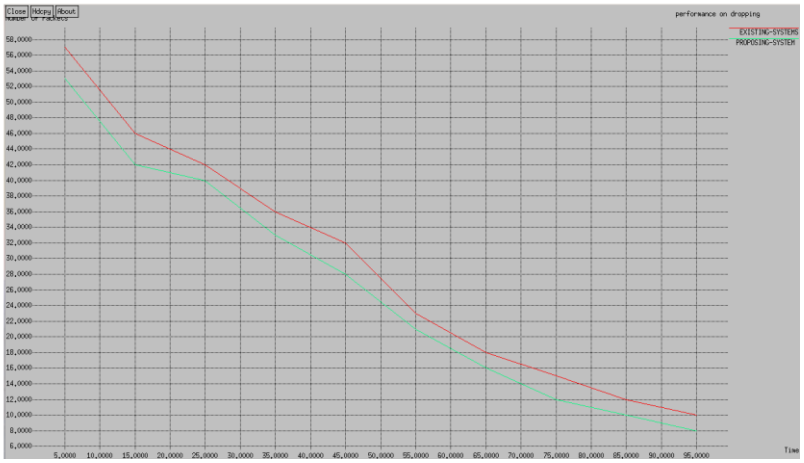
## VII. EXPERIMENTAL RESULTS



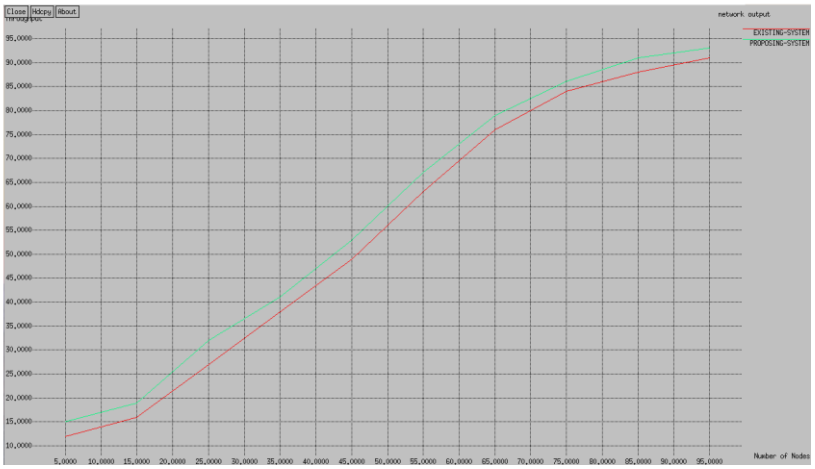

The above figure shows that packet delivery ratio in network. In this graph, time versus percentage of data packets delivered. The simulation time increments in network then parallely number of packets delivered. In this performance ratio of proposed system increments compared to existing Algorithm.



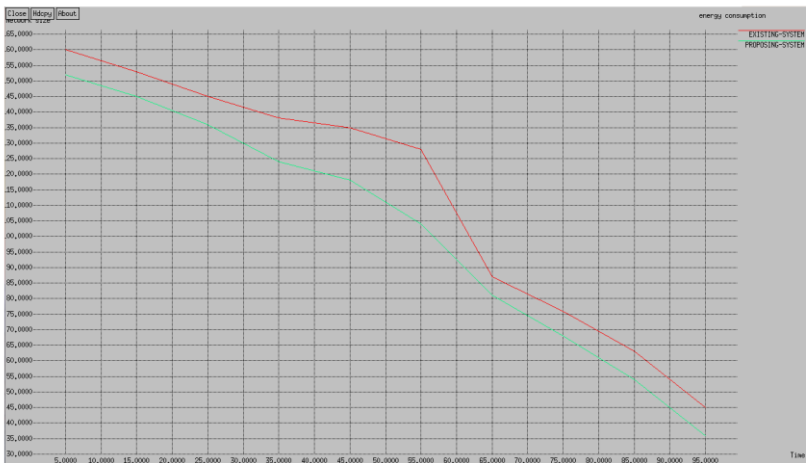

The above graph shows delay time in network. This graph shows, time versus number of packets transmission rate. Here simulation time increments then number of packets delivering time decrements. In this, performance of delay time of proposed decreases compared to existing.




The above graph shows the performance of dropping. In this graph, time versus number of packets is given. Here as the simulation time increments then how many packets are dropped is shown in this network. In this, the performance of dropping ratio on proposed system will be decreased compared to existing.




The above graph shows the network output. In this graph, number of nodes versus throughput is given. Here the performance of network is incrementing in proposed system compared to existing schemes.




The above graph shows the energy consumption. In this graph, time versus network size is taken. Here as simulation time increments the network performance decreases. In this the performance of energy consumption in proposed system decreases compared to existing.

## VIII. CONCLUSION

A complete survey is carried out here on the said topic and most technically relevant contributions are focused. Routing protocol is the most important factor that supports like a backbone behind any fruitful data transmission. So this analysis will be useful for further developing many novel routing protocols for MANETs based on AODV. In this survey many novel proposals are discussed which are improved over traditional AODV and each of their mechanism focuses on the routing method used and further opens scope for improvement. In this paper, a new multipath routing algorithm is suggested based on AODV that uses all directional antenna to discover and use regional distinct paths. To achieve this goal, active neighbors of each path are counted. Also, selection is executed based on the number of active neighbors.

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