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An Enhanced Light-weight Proactive Source Routing Protocol using DIFT-BFHS for MANET

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ABSTRACT

A mobile ad hoc network (MANET) is a foundationless wireless communication network with a collection of mobile nodes, these nodes are not lies within the direct transmission range of each other but depend on the intermediate nodes for data transference. In multi hop wireless networking the opportunistic data forwarding related research has drawn much attention. The main reason for opportunistic data forwarding has not been widely utilized in mobile ad hoc networks (MANETs) because of lack of an effective lightweight proactive routing feature with strong source routing capability. In this research the PSR working is modified by Depth-first iterative-deepening combined with the best first heuristic search to maintain the information of the entire network topology. DIFT-BFHS spanning tree is constructed to maintain the network topology information. Instead of repeatedly updating this information, the updating is made only when modification occur, in network topology through the nodes. This makes the acquaintance node discovery process simple and reduces the routing overhead; therefore the vigor is saved as much as possible.

Keywords: MANET, DFIT-BFHS, cluster

1. INTRODUCTION

MANET [1] is well growing technology used in various applications which is opposed to the framework of wireless network. MANET is a collection of mobile nodes operates without any base station and they communicate with each other over a wireless connection. The network layer has received a deal in the research on MANETs. The two main operation performed by the MANET in this layer is Data forwarding and Routing. Data forwarding is the process of taking the packets from one connection and delivered on another connection.

Routing provides the path that should be followed by the packets to reach the destination. Many researchers focused in researching how to makes the wireless links as good as wired links. Way to achieve the broadcast nature of wireless communication link is Opportunistic Data Forwarding[2](ODF). It describes the way in which the data packets are handles within a multihop wireless network. The ODF allows many downstream nodes to perform on propagation of data packets. Each node in MANET maintains a routing table that contains the available destination, number of hops etc. In order to support the ODF in mobile ad hoc network an IP packet is enhanced to lists the address of the nodes which leads the packets target. This mechanism needs routing protocols which allows the nodes to see beyond the next hop to reach the destination. To do so the link state routing [3] and source routing [4] is the suitable protocols. But the link state routing protocols such as optimized link state routing leads to larger overhead. On the other hand the source routing is applicable for large scope and it cannot be used for this research.

This research work proposed an improved light weight proactive source routing (PSR) protocol in MANETs to enhance the opportunistic data forwarding process. Basically, the nodes in PSR maintains a breadth-first search spanning tree of the network, but in this research the PSR working procedure is slightly modified by implementing Depth-first iterative-deepening[5](DFIT-BFHS) combined with the best first heuristic search[6] to maintain the information of the entire network topology. By selecting an effective cluster head based on (TRBC-Transmission Range Based Clustering) [7] the DIFT-BFHS spanning tree is constructed to maintain the network topology information. Instead of periodically updating this information, the updating is made only when modification occur, in network topology through the nodes. This makes the neighbor node discovery process simple and reduces the routing overhead, therefore the energy is saved as much as possible.

The further process of this work is organized as follows. Section 2 describes the related review on, neighbor node discovery; routing overhead reduction etc. section 3 describes the detailed explanation of proposed methodology and the simulation result of this research work is shown in section 4 then it is concluded in section 5.

2. RELATED WORKS:

In recent years many researchers performs their research work on MANETs owing to the interesting nature of mobility. This section describes some related research such as neighbor node discovery, energy consumptions, routing overhead reduction and route discovery which is most relevant to the proposed paper.

Walikar Gyanappa A and Biradar Rajashekar C(2015), “Energy aware multicast routing in mobile ad-hoc networks using NS-2”, introduced an Energy Aware Multicast routing Protocols which increase the energy consumption which discovering the neighbor node ,maximized end-to-end connectivity and reduced the fault in node /link level effectively. The entire research work is processed in five phases. One is node energy model, second is nodes pruning is performed which having less residual energy, third is multipath route detection by using request and reply packets then final stable route selection by considering energy of nodes. Next route maintenance and final step is simulation analysis of used parameter.

Xin Ming Zhang et al (2013) proposed a novel protocol known as neighbor coverage-based probabilistic rebroadcast protocol that removes the broadcast storm problem by reducing routing overhead in MANETs. A novel mechanism Rebroadcast delay is introduced to obtain the neighbor coverage knowledge that determines the rebroadcast order. The node density adaptation is defined by the connectivity factor. These connectivity factor and the neighbor coverage knowledge is combined to reduce the number of retransmission, this the way used by the author to reduce the routing overhead.

Katal A et al (2013) presented novel techniques for cluster head selection and also to find the super head cluster which is a part of the network but not a cluster member, monitoring the cluster head behavior whether it is working properly or not. A node which passes in the parameters such as Relative Velocity, Hop count, Fairness at time, communication range, and battery poweris selected as the cluster head. After this super cluster head selection process is performed.A node that should not be a cluster head and it must contains maximum battery power is selected as super cluster head. This kind of cluster head and super cluster head is electing to increase the life time of the network.

The above section describes the review that has the limitation in several areas in MANET. The following section explains how these drawbacks are rectified by proposing novel techniques.

3. PROPOSED METHODOLOGY

The proposed work introduced a source routing protocol which is proactive in nature this makes the ODF available for MANETs. Traditionally the nearby nodes periodically exchange this information to obtain an updated network topology this leads to the routing overhead. This problem is reduced in this work by improving PSR that maintains DIFT-BFHS spanning tree of whole network within a cluster by having each node in the network. A cluster is formed by selecting an effective cluster head and by considering that CH as root node the DIFT-BFHS spanning tree is constructed. Instead of nodes to maintain the routing table the CH does this job of maintaining the route table of all nodes in the network.

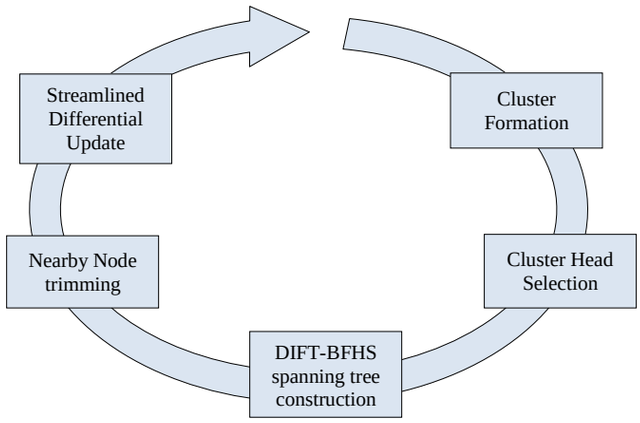

Figure 1 Frame work of proposed Approach

Route Update:

The cluster head selection is described below.

Cluster formation:

In this paper the cluster formation is performed by TRBC-Transmission range based Clustering. This work is based on two phase i) Transmission Range Identification, ii)Link Stability. Initially the cluster is formed by calculating the transmission range. Cluster head selection is performed on by considering various factors such as energy, capacity, stability, mobility and throughput of node. The cluster head should have some special functionality when compared to other nodes. In this research work the cluster head is selected based on high link stability.

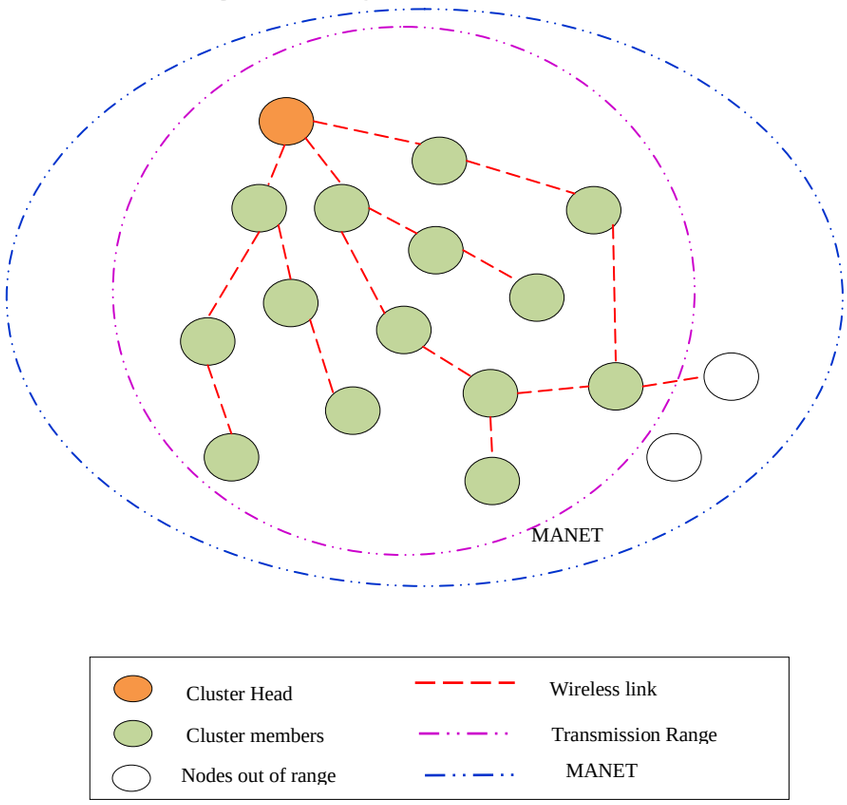

Figure 2 Cluster with cluster head and its members

Transmission Range Identification:

Among the incoming nodes the cluster head is selected by applying the weighted clustering Algorithm. Then the distance of the nodes is calculated and the maximum distance is taken as radius for coverage area within the transmission range. Next the desired transmission range based on desire node degree and current node degree is calculated where the equals contention index $EC_i$is increased by one.Finally the transmission range is calculated. The cluster formation and its head selection algorithm is given below.

In the below algorithm the cluster is formed based on the transmission range by calculating the distance of acquaintance node, desire node degree and current node degree., with this range desired number of cluster will be formed which leads to greater stability and lower power consumption.

D: Distance
DND: Desire Node Density
CND: Current Node Density
CA: Coverage Area
N_i: Nodes
CH: cluster Head
Begin
Set D as distance of node that enters into the cluster
MD=max (D);
Set desire node degree by incrementing 1
DND= node density +1
Calculate transmission range
$TR = \sqrt{\left(\frac{DND}{CNA}\right) CA}$
Compare D with $AVG(TR)$
If$(D \neq AVG(TR))$
Set N_i =out of range
End if
Find link stability
$LS = TR/D$
Set CH=max (LS)
End

This section describes the cluster formation and its head selection and the following section explains the spanning tree construction with cluster head.

Heuristic Search Spanning Tree (HSST):

The proposed PSR maintains each and every node with the whole route information, which is collected from all other nearby nodes.

The nodes communicate with each other by identifying the neighbor node within a range, from to gain the knowledge of network topology. In MANETs each node maintains a routing table that contains the information about the available destination, number of hops of each route. This information is shared among the all other node in the network to obtain the knowledge of network topology. Owing to the nature of proactive, the route updation process has more iteration in PSR. Many iteration for route updation cause the high power consumption therefore it limits the wide application of MANETs. In order to solve this problem Depth-first iterative-deepening is combined to best first heuristic search such as A* to reduce the iteration by decreasing the depth of the search. The DFID-BFHS spanning tree is constructed with a cluster head which is responsible for maintaining the network topology information.

Depth-First Iterative-Deepening (DFID):

The DFID is similar to the breadth-first search it uses less memory on every iteration. This search finds the solution starting from initial stage and performs the depth-first search for goal node selection. In each iteration the node in the previous search is discarded. The search is repeated until it reaches the goal. All nodes are expanded by DFID at a given depth before expanding any nodes at a greater depth. O(d) is the space used by this search algorithm . The demerits of DFID is it process the wasted computation prior to obtain the goal so it's combined with Best-First Heuristic Search A* (BFHS)

Best-First Heuristic Search (BFHS) A*:

Heuristic is a method proposed by Judea Pearl on 1984 to decide most effective alternative courses to achieve the goal. Heuristic search algorithm does not find the best solution every time instead it guaranteed to search a solution in a reasonable time. This search uses the initial state, operators for finding adjacent state, test function and heuristics for exploring the next state.

Nearby Node Trimming:

An adaptive HELLO messaging technique is used in the proposed work which is used for the network topology updating. When cluster head receives a HELLO message, it adds the sender of that packet in its routing table. In traditional methods when a

node receives a hello message then it add the source of that packet in its routing table and estimates their own and neighbor node velocity vector to set the expiration time for the entry in the neighbor table.

The HELLO messaging with a fixed period have the drawbacks such as: increased network congestion, wasted bandwidth, delaying of data packet .At the same time, if the velocity vector information helps to estimate the availability of a node, the packet rate can be made adaptive. Thus, the improved PSR uses an adaptive HELLO messaging technique where the messaging interval is changed according to the number of the registered nearby neighbors. The basic messaging interval of 0.5 s is multiplied by a weight proportional to the number of registered neighbors. And these whenever the nearby nodes deemed lost then its contribution to the network connectivity should be eliminated this process is known as nearby node trimming.

4. EXPERIMENTAL RESULT:

This study work is performed using computer simulation with Network Simulator 2 version 2.34 (ns-2). The comparison is performed between the improved PSR with traditional PSR. Our tests show that the overhead of improved PSR is only a fraction of that of the existing one. Nevertheless, as it provides global routing information at such a small cost, improved PSR offers similar or even better data delivery performance. The performance evaluation is described in constant bit rate, nodes and speed respectively.

Parameters	**Values**
Channel type	Wireless Channel
radio-Propagation model	Two Ray Ground
network interface type	Wireless Phy
MAC type	802_11
interface queue type	Drop Tail /Pri Queue
Radio Range	250M
link layer type	LL
antenna model	Omni Antenna
max packet	50 (Minimum:512bytes, Maximum: 10,000bytes)
number of mobile nodes	50 (Minimum:50, Maximum: 200)
routing protocol	AODV
Simulation time	200 s(Minimum:200s, Maximum:10000s)
X dimension of topography	1000
Y dimension of topography	1000
Traffic	CBR(Constant Bit Rate)
Node Speed	5,10,15,20,25,30s
Mobility Model	Random Way point

Constant bit rate:

In this section, the comparative performance of average delay, overhead, packet delivery ratio and bandwidth are discussed with the constant bit rate of proposed work and existing work. Average delay is represented by millisecond. The proposed work average delay is low compared to the existing protocol.

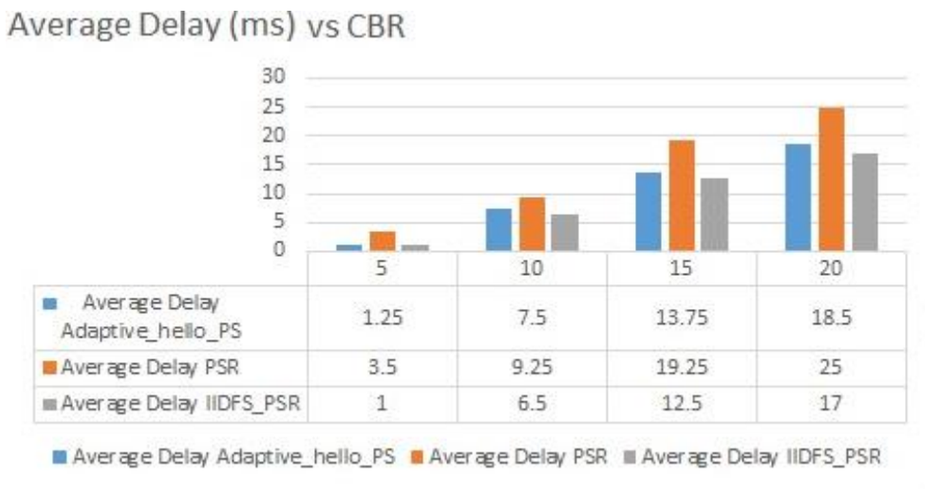

Figure 1. Average delay versus Constant bit rate

In figure 1.packet delivery ratio of posit protocol is high compared to the existing protocol. It is represented by milliseconds. In this figure 1, we show that the high packet delivery ratio while varying the constant bit rate in posit work

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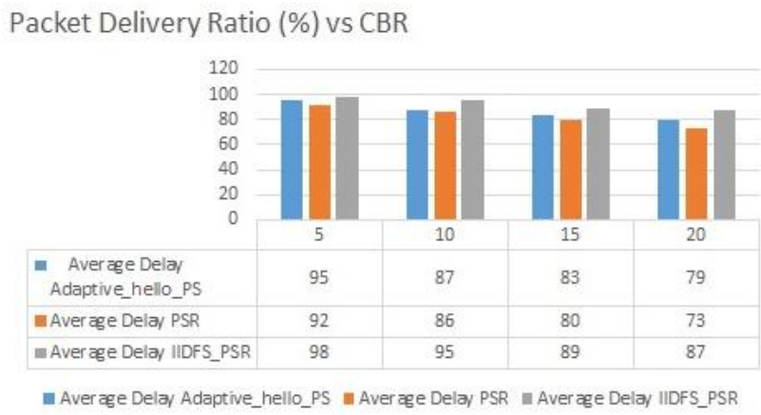

Figure 2. Packet delivery ratio versus Constant bit rate

Nodes:

In this section, we discussed about the performance comparison of average delay, overhead, bandwidth and packet delivery ratio and with varying nodes of proposed work and existing work.

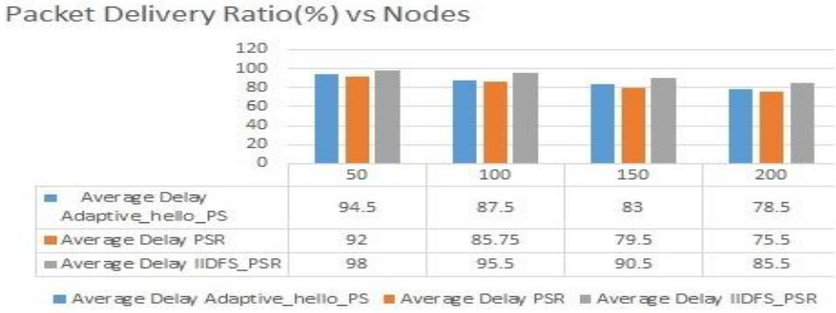

Figure3. Packet delivery ratio versus varying nodes

Speed

In this section, we discussed about the compare the performance of average delay, overhead, packet delivery ratio and bandwidth with varying speed of proposed work and existing work.

Figure 4.average delay vesus varying speed

In figure 4.Bandwidth of proposed protocol is high compared to the existing protocol. It is represented by milliseconds. In this figure 5, we show that the high packet delivery ratio while varying the speed in proposed work.

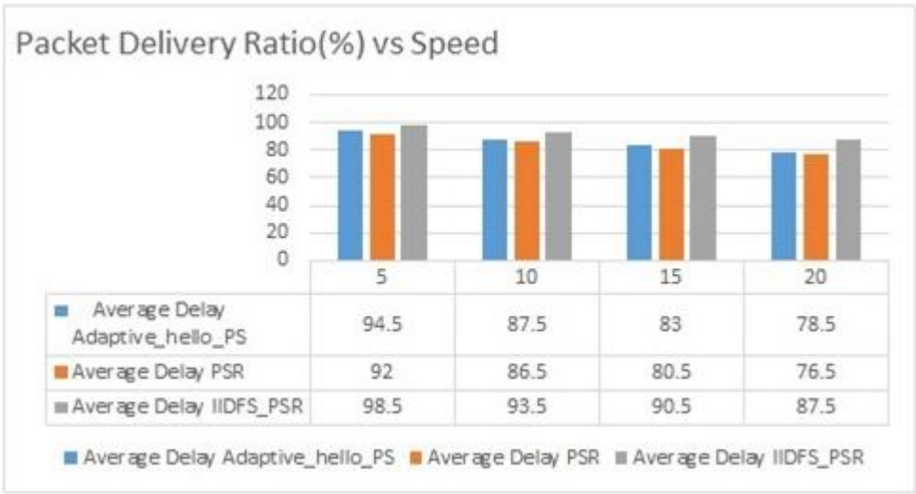

Figure5. Packet delivery ratio versus varying speed

In figure 6, packet delivery ratio of proposed protocol is high compared to the existing protocol. It is represented by percentage. In this figure 7, we show that the high packet delivery ratio while varying the speed in proposed work.

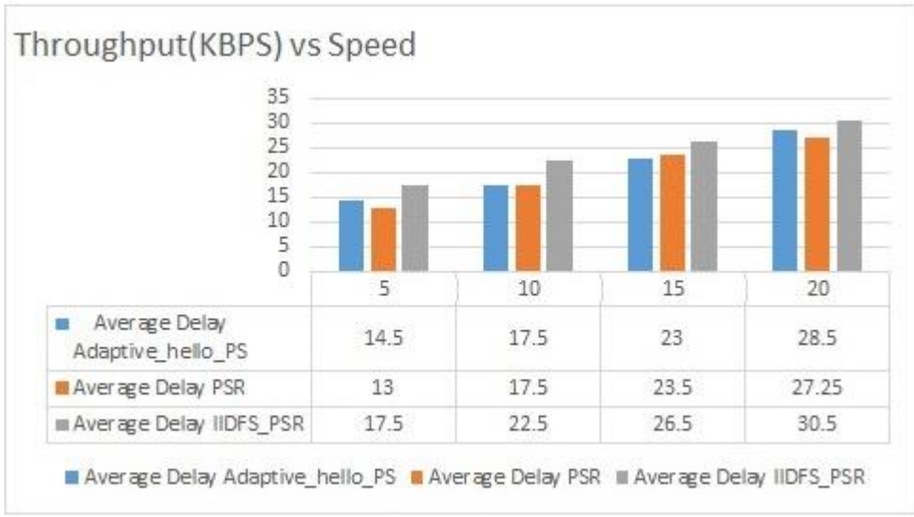

Figure 6

In figure 7 , average delay of proposed protocol is low compared to the existing protocol. It is represented by milliseconds. we show that the low average delay while varying the speed in proposed work

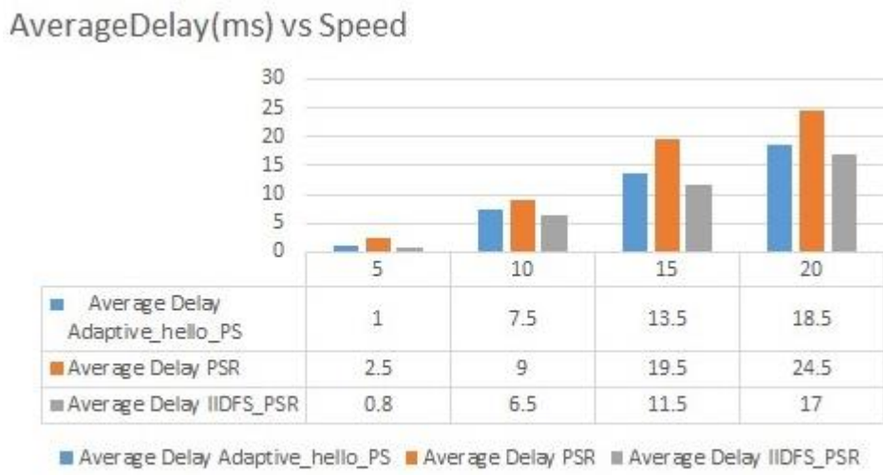

Figure7. average delay versus varying speed

Figure 8. Overhead versus varying speed

In figure 8, packet delivery ratio of proposed protocol is high compared to the existing protocol. It is represented by percentage. In this figure 3, we show that the high packet delivery ratio while varying the constant bit rate in proposed work

5. CONCLUSION:

In this research the PSR working procedure is slightly modified by implementing Depth-first iterative-deepening (DFID) combined with BFHS algorithm within the cluster to maintain the information of the entire network topology. The cluster formation is performed by transmission range based clustering, in which the transmissions range is founded initially and then cluster head is selected. DFID is similar to the breadth-first search it uses less memory on every iteration and BFHS algorithm is applied to all nodes. where nodes has full path information to route itself and can reduce overhead as much as possible for link stability and location stability, each node carrying link with highest density and efficient transmission power with adaptable location. The location stability which implies node is on the stable state which is ready state to send the number of packets to the intended destination node with degrading the network performance with the combined result of this both is used for constructing the spanning tree, finally cluster head updates the routing tables based on the adaptive Hello Messaging technique .Due to mobility of the nodes more energy is consumed. The proposed systems use an innovative technique for reducing energy consumption and reduce the overhead. In this technique the delay is selected until the end of the cycle so that only one update is propagate in each period. Furthermore, due to the dynamic topology, node consumes more energy while roaming.

REFERENCE:

[1].Srivastava A, Mishra A, Upadhyay B, Yadav A K,. "Survey and overview of Mobile Ad-Hoc Network routing protocols", Advances in Engineering and Technology Research (ICAETR), Pp: 1 - 6, 2014.

[2].Z. Wang, Y. Chen, and C. Li, "CORMAN: A novel cooperative opportunistic routing scheme in mobile ad hoc networks," IEEE J. Sel. Areas Commun., vol. 30, no. 2, pp. 289–296, 2012.

[3]. Shakkeera, "Optimal path selection technique for flooding in link state routing protocol using forwarding mechanisms in MANET" International Conference on Communication and Computational Intelligence (INCOCCI), Pp: 318 – 323, 2010.

[4]. Wang, Z.W.; Liang, M.G.; Zhang, J.X, "Vector Switching Scheme (VSS) for Source Routing Protocol of MANET", IET 2nd International Conference on Wireless, Mobile and Multimedia Networks (ICWMMN 2008).

[5]. Richard E. Korf , "Depth-first iterative-deepening: an optimal admissible tree search", Journal of Artificial Intelligence, Vol 27, No: 1, Pp: 97 – 109, Sept. 1985.

[6]. Richard E. Korf, "Depth-first iterative-deepening ☆: An optimal admissible tree search", Artificial Intelligence Vol 27, No 1, Pp 97–109, 1985.

[7]. S.Muthuramalingam and R.Rajaram, "A Transmission range based clustering algorithm for topology control manet" International journal on applications of graph theory in wireless ad hoc networks and sensor networks (GRAPH-HOC) Vol.2, No.3, 2010.

[8]. Walikar Gyanappa A and Biradar, Rajashekar C, "Energy aware multicast routing in mobile ad-hoc networks using NS-2", IEEE International Conference on Electrical, Computer and Communication Technologies (ICECCT), Pp: 1 - 7, 2015.

[9]. Xin Ming Zhang, En Bo Wang, Jing Jing Xia and Dan Keun Sung, "A Neighbor Coverage-Based Probabilistic Rebroadcast for Reducing Routing Overhead in Mobile Ad Hoc Networks", IEEE Transactions on Mobile Computing, Vol: 12, No: 3, Pp: 424 - 433, 2013.

[10]. Na Li and Sajal K. Das, "A trust-based framework for data forwarding in opportunistic networks", Ad Hoc Networks 11 (2013) 1497–1509

[11].Katal A, Wazid M, Sachan R S, Singh D P, Goudar R H, "Effective Clustering Technique for Selecting Cluster Heads and Super Cluster Head in MANET", IEEE International Conference on Machine Intelligence and Research Advancement (ICMIRA), Pp: 1 - 6, 2013.

[12].Judea Pearl. Heuristics: Intelligent search strategies for computer problem solving. Assison-Wesley, 1984.