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Improving The QOS In MANET Using Dynamic Efficient Power Consumption Based Congestion Control Scheme

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Abstract: ***The Mobile Ad hoc Networks are considered as a new paradigm of infrastructure-less mobile wireless communication systems. Routing in MANETs is considered as a challenging task due to the unpredictable changes in the network topology, Nodes can dynamically join and leave the network without any warning and All nodes in network are energy dependent and efficient energy utilization is one of the important criteria in MANET. In this research work, propose the Dynamic Efficient Power Consumption Congestion Control Scheme (DEPCCCS) for congestion control and improving the quality of service in mobile network. The dynamic behavior of network connection is not maintained for long time. In a mobile network nodes are not aware about their energy status, some situation routing packets are consumes more energy. In this paper, the DEPCCCS is incorporated in the routing protocol to reduces that possibility of destination finding by maintain the record of location of each node in network respect to wireless base station is used. The central base station stores locations of the mobile nodes in a position table. The proposed protocol dynamically calculates every nodes energy status and their current location and speed for the minimum energy consumption for mobile nodes. And also the proposed scheme presents congestion control and power consumption. By simulation results, shown that our proposed technique attains better delivery ratio and throughput with less delay and energy consumption when compared with the existing technique.***

Keywords: MANET, Congestion, Node energy, LAR.

Introduction

The Mobile Ad hoc Networking (MANET) is a collection of mobile nodes that are connected over various wireless links. In MANET there is no any existence fixed infrastructure. It is relatively working on some constrained bandwidth. In MANET, congestion control is a major problem. Congestion means when transmission of number of packets across the network is greater than the capacity of the network then network becomes congested. Due to congestion packets have to be dropped and also decrease the performance of the network.

Due to mobility of nodes in MANET, it is not possible to establish fixed paths for message delivery through the network. Hence, congestion is happening and it is the key problem for MANET. Actually, Congestion is situation in communication network when too much traffic is offered and the Congestion on MANET leads to Packet losses, Bandwidth degradation, Wasting of time (i.e. long delay), High overhead. So, many routing protocols have been proposed to overcome the congestion in MANET. [1][3]. Enormous congestion control algorithms have been proposed. However, those algorithms have failed to dynamically adjust to provide the best solution based on the status of the energy. The proposed DEPCCCS, incorporates the benefits of dynamic energy efficiency and reduces the congestion effectively.

Related Work

Kartik Chandran et al [3] proposed TCP Feedback it is a feedback based approach to handle the route failures in MANETs. The approach allows the TCP sender to distinguish between losses due to route failures and those due to network congestion. In this scheme, the source informed of the route failure with the help of a Route Failure Notification(RFN) so that it does not unnecessarily invoke congestion control and can refrain from sending any further packets until the route restored with Route Re-establishment Notification(RRN). For this, it uses a single bulk data transfer session, where a source mobile host sending packets to a destination mobile host As soon as the disruption of a route due to the mobility of the next mobile host along that route detected, a route failure notification (RFN) packet explicitly sent to the source and this event is recorded. In this algorithm focuses on network parameters like Data rate, Failure rate, Route re-establishment delay (RDD).

Som Kant Tiwari et al[26] says Explicit congestion notification (ECN) mechanism capture network congestion status by using feedback based mechanism. It determines the level of congestion more accurate than pure end-to-end schemes with an ECN-like marking scheme. The purpose of the ECN bit is to notify TCP sources of an initial congestion and mark packets before losses occur. ECN is a binary indicator which does not reflect the congestion level and its convergence speed is relatively low due to insufficient congestion feedback. They proposed a novel approach to handle congestion in MANETs.

Cross layer hop by hop congestion control scheme is proposed to improve TCP performance in multi-hop wireless networks which coordinates the congestion response across the transport, network, and transport layer protocols. The proposed scheme attempts to determine the actual cause of a packet loss and then coordinates the appropriate congestion control response among the MAC network, and transport protocols. The congestion control efforts are invoke at all intermediate and source node along the upstream paths directed from the wireless link experiencing the congestion induced packet drop [6].

In the cross layer based congestion control techniques applied over a Ad hoc On demand Multipath Reliable and Energy Aware QoS Routing Protocol (AOMP-REQR)[9]. The technique of additive increase and multiplicative decrease (AIMD) applied for rate based congestion control of transport layer protocol. If source receives congestion status information from both MAC and transport layer simultaneously for the same route, then congestion free route will be established for transmission, without performing rate control. In transport layer, if the rate of packet delivered through the route exceeds the predefined threshold, it will lead to congestion problem. In MAC layer the congestion occurs due to the signal interference. If the congestion problem occurs in both the layers at the same time, a node formulates a list containing affected route entries and this information is broadcasted to the corresponding nodes. The nodes upon receiving the message send the congestion information to source so that data packet rate of the source is reduced or another congestion free route is selected.

Ashish Kumar Mourya, Niraj Singhal [25] both are developed Mobile agent based congestion control Technique proposed to avoid congestion in ad-hoc network. In this technique, the information about network congestion is collected and distributed by Mobile Agents (MA) A mobile agent based congestion control AODV routing protocol is proposed to avoid congestion in ad hoc network. Here, the node is classified in one of the four categories depending on whether the traffic belongs to background, best effort, video or voice AC respectively. Then MA estimates the queue length of the various traffic classes and the channel contention of each path. Then this total congestion metric is applied to the routing protocol to select the minimum congested route in the network. The mobile agent based congestion control AODV routing protocol reduces the end-to-end delay and the number of route discovery requests, balances the traffic load [25].

An Efficient Energy based Congestion Control Scheme (EECCS)[24] for in this research work I have consider as this one existing method to control the congestion level and to improve energy efficiency of the mobile nodes. Here the cross layer design have deployed to improve the network performance. The multipath routing is focused to avoid congestion and to increase network lifetime. Efficient Energy based Congestion Control Scheme (EECCS) were implemented with the three phases. In first phase, the cross layer based multipath routing have developed to reduce effect of packet loss, packet drops and to achieve the load balancing in MANET. In second phase, the energy consumption model have integrated in the cross layer model to acquire minimum energy consumption of mobile nodes. In third phase, the packet format of the proposed scheme explored to monitor the status of the congestion level, energy level and packet loss level.

EECCCP was depending on individual receivers to detect congestion and adjust their receiving rates. In the first phase of the proposed protocol, it builds a cooperative multicast tree rooted at the source, by including the nodes with higher residual energy towards the receivers. In the second phase of the proposed protocol, it proposes an admission control scheme in which a cooperative multicast flow is admitted or rejected depending upon on the output queue size. In the third phase of the proposed protocol, it proposes a scheme which tests whether the relay node has the potential path to the required destination, if not then choose the another node which has the second highest residual energy as a new relay node. That is more generally introduction of cooperativeness and making it. In the fourth phase, were proposed a scheme which adjusts the multicast traffic rate at each bottleneck of a multicast tree. Because of the on-the-spot information collection and rate control, this scheme has very limited control traffic overhead and delay[13].

An Energy Efficient and Reliable Congestion Control (EERCC) protocol for multicasting in MANETs. The proposed scheme overcomes the disadvantages of existing multicast congestion control protocols (AODV) which depend on individual receivers to detect congestion and adjust their receiving rates. The energy efficient and reliable congestion control protocol for multicasting in MANETs is implemented in three phases: In the first phase of EERCC protocol, a multicast tree routed at the source was billed by including the nodes with higher residual energy towards the receivers. In the second phase an admission control scheme was proposed in which a multicast flow is admitted or rejected depending upon on the output queue size. In the third phase a scheme which adjusts the multicast traffic rate at each bottleneck of a multicast tree is proposed [12].

Dynamic Congestion Detection and Control Routing (DCDR) in ad hoc networks based on the estimations of the average queue length at the node level. Using the average queue length, a node detects the present congestion level and sends a warning message to its neighbors. The neighbors then attempt to locate a congestion-free alternative path to the destination. This dynamic congestion estimate mechanism supporting congestion control in ad hoc networks ensures reliable communication within the MANET [11].

S. Subburam et.al[15] developed Predictive congestion control mechanism for MANET Unlike traditional AODV, predictive congestion index of a node as the ratio of current queue occupancy over total queue size at node level. Based on a congestion index, PCCAODV utilizes the upstream nodes and downstream nodes of a congested node and initiates route finding process Bi-directionally to find alternate non congested path between them for transmitting data. Suppose that the process find more non congested multi-paths and decides a finest single path for transmitting data The PCCAODV contains the components are Route discovery, Predictive congestion detection, Bidirectional path discovery.

Claudio Greco et.al[27] proposed a method for Low-Latency Video Streaming with Congestion Control in Mobile Ad-Hoc Networks. They address the challenge of delivering a video stream, encoded with multiple descriptions, in a mobile ad-hoc environment with low-latency constraints. This kind of application is meant to provide an efficient and reliable video communication tool in scenarios where the deployment of an infrastructure is not feasible, such as military and disaster relief applications. First, they employs a reliable form of one-hop broadcast to build an efficient overlay network according to a multi-objective function that minimizes the number of packets injected in the network and to maximizes the path diversity among descriptions. a cross-layer congestion control strategy where the MAC layer is video-coding aware and adjusts its transmission parameters (namely, the RTS retry limit) via congestion/distortion optimization. The main challenge in this approach is providing a reliable estimation of congestion and distortion, given the limited information available at each node.

S. Sound. et al.[14] proposed in order to overcome the issues an efficient multi-path routing protocol ABMRLBCC (Ant Based Multi-path Routing for Load Balancing and Congestion Control) based on Ant Colony Optimization were proposed. A reactive path set up by the forward ant which provides the routing information of a node. The best path for each ant is selected based upon the number of hops and travel time. The backward path selection scheme determines the common node and the path which has been omitted. The omitted reverse path number and the common node number are used for determining the best forward path. The path which has a lower common node number is chosen as the best path. The probability of breakage is lesser when there is less number of common nodes. After setting up the route, data packets are routed over different paths according to the pheromone tables. Then load balancing technique is applied in this protocol to alleviate the congestion.

S.Rajeswari et.al[16] evaluated the performance of four queuing disciplines (FIFO, PQ, RED and WFQ) which is implemented in the AEERG protocol.

Proposed Model

Congestion control is a challenging task in mobile ad hoc network. Congestion occurs when the demand is greater than available resources. Different types of mechanisms have been proposed to overcome the congestion in the mobile ad hoc network. In highly congested condition, the quick changes such as decreasing network performance or collision, cause bandwidth wastage and high variation in delay.

The problem is, How to *effectively* and *fairly* allocate resources among a collection of competing users?

The nodes in a network are battery dependent for their communication. So the most important parameter for optimization is energy conservation. The energy is required to nodes in network for communicating with each other and for every data sending and receiving the nodes are consumes the energy. Nodes need to reduce their power consumption to prolong their battery lifetime. Therefore, the transmission power should be carefully chosen since the large transmission power level leads to the waste of battery energy.

This paper presents Dynamic Efficient Power Consumption Congestion Control Scheme multicasting in mobile ad hoc networks (MANETs). The proposed scheme overcomes the disadvantages of existing congestion control technique

3.1. Proposed Scheme for Improving Energy Efficiency and Power Constrain

Mobile nodes in MANETs are battery driven. Thus, they suffer from limited energy level problems. Also the nodes in the network are moving if a node moves out of the radio range of the other node, the link between them is broken. Thus, in such an environment there are two major reasons of a link breakage. Node dying of energy exhaustion, Node moving out of the radio range of its neighboring node.

In this research, the possibility of using LAR protocol to improve performance of routing protocols for MANET. As an illustration, show how a route discovery protocol based on flooding can be improved.

LAR:

It uses location information of the mobile nodes to limit the search for a new route to a smaller area of the ad hoc network which results in a significant reduction in the number of routing messages and therefore the energy consumption of the mobile nodes batteries is decreased significantly. In order to reduce the control overhead due to broadcast storm in the network when control packets are flooded into whole network.

The following are the route discovery scenario of this research work:

i. In this Research uses a wireless Central Base Station (CBS) that covers all Mobile Nodes (MNs) in the network. BS divides the network into sub areas.
ii. In order for BS to efficiently route packets among MNs, it keeps a Position Table (PT) that stores locations of all MNs.
iii. Each mobile node contains area ID
iv. MNs local positions are estimated the distance between the MN and CBS
v. When a source node needs to transmit data, it first queries CBS about the area id of the destination node, then data packets are flooded into that area only.
vi. First, it creates and executes position table which builds and updates the PT in CBS. Then, LAR executes an infinite loop. In this loop, whenever a new mobile node enters the network area of CBS then PT will update.
vii. when new mobile node enters the network area of CBS its location estimation method to determine its (x, y) position and sends a broadcast message that contains its position.
viii. when source node send message to destination node, its send request to CBS, and CBS calculate the Destination node position.

And find all node set initial energy as a random after that, sender broadcast routing packet to find receiver, in route broadcasting time energy module base and find out intermediate node energy if energy value is greater than threshold value then we insert that node in route else eliminate that route path, after that we find out receiver node on the bases of threshold energy base routing and receivers sends acknowledgment packet to the actual sender, but after some time any node move and connection break down than receiver uses LAR (Location aided routing) and sends location information to sender node time to time through central base station, that message help full for finding receiver from minimum overhead bases because LAR uses direction base routing. In this method uses the minimum power to find the routing path.

Energy Consumption,

$$Ec = \sum_{i=1}^{k} \mathrm{T}(\mathrm{ni}, \mathrm{ni}+1)$$

Power Constrain Calculation, there are two routing objectives for minimum total transmission energy and total operational lifetime of the network can be mutually contradictory. For example, when several minimum energy routes share a common node, the battery power of this node will quickly run into reduction, shortening the network lifetime. The path is then selected by choosing the path with the maximum lowest hop energy. we want to predict the nodes life time and path life time based on that the power constrains calculated.

3.2. Proposed Congestion Control

The Mobile Ad hoc Networking (MANET) is a collection of mobile nodes that are connected over various wireless links. In MANET there is no any existence fixed infrastructure. It is relatively working on some constrained bandwidth. In MANET, congestion control is a major problem. Congestion means when transmission of number of packets across the network is greater than the capacity of the network then network becomes congested. Due to congestion packets have to be dropped and also decrease the performance of the network.

Two types of approaches to control congestion are network resource management and traffic control. In the first approach, the network resource is increased to reduce congestion when it occurs. In a wireless network, power control and multiple radio interfaces can be used to increase the bandwidth and weaken congestion. In contrast with the network resource management approach, traffic control adjusts the traffic rate at the source nodes or intermediates nodes, to control congestion. This approach is more feasible, efficient and useful to save the network resource. Most of the existing congestion control protocols are based on the traffic control approach.

In this research work, the traffic control approach has been taken to control the congestion and improve the quality of services over the mobile network.

Here use admission control to prevent intermediate node from being overloaded and reject requests of new sources if there is no available bandwidth; when an intermediate node receives a QoS route request and has enough available bandwidth, it accepts this request and allocates bandwidth for it. When the intermediate node receives a reply for the request, it changes the status of the reserved bandwidth from Allocated to Reserved. The reserved bandwidth stays in reserved status until the forward node is reset. If the intermediate node receives a QoS route request and there is no available bandwidth, it rejects this request. To make a correct decision for accepting or rejecting the new request, the network layer should interact with the MAC layer to estimate available bandwidth.

In this case the wireless network has two states:

1. Busy state (transmitting, receiving and carrier sensing channel).
2. Idle state.

Each node will constantly monitor by the base station, when the channel state changes; it starts counting when channel state changes from busy state (transmitting, receiving and carrier sensing channel) to idle state and stops counting when channel state changes from idle state to busy state.

if the $N \le Thrs_1$ is accepted the flow

otherwise if the $N > Thrs_1$ is rejected the flow

Simulation & Result Analysis

Here, in order to validate the proposed scheme and show its efficiency we present simulations using network simulator version 2.35 (NS-2.35). NS-2 is a very popular network simulation tool. It uses C language for protocol definition and TCL scripting for building the simulation scenarios. The simulation environment settings used in the experiments are shown in Table I. The simulation duration is 200 seconds and the network area is 1000 meter x 1000 meter that includes variable number of mobile nodes ranging from 50 to 250. A Constant Bit Rate (CBR) is generated as a data traffic pattern of the mobile nodes are selected randomly as CBR sources. The scenario of nodes mobility is generated randomly based on random way point model where a mobile node moves to a new position and pauses there for time period between 0 to 3 seconds, then it move to another position

Simulation settings

Table 1 : NS2 simulation environment settings

Parameter	**Setting Value**
Network area	1000 X 1000
Number of mobile nodes	25,50,75,150
MAC	802.11
Simulation time	200ms
Mobility model	Random Way Point
Pause time	0to3
Node transmission range	250m
Type of traffic	CBR
Data packet size	512 bytes
Speed	5m/s
Pause time	5s
Transmit Power	0.744 w

Receiving Power	0.0648w
Idle Power	0.335w
Speed 5m/s	Speed 5m/s

Results and analysis

The performance of the proposed system has been measured in terms of following metrics:

i. **Packet Delivery Ratio:** The ratio of the number of data packets successfully delivered to the destinations to the total number of data packets actually sent by the sources.

ii. **Throughput:** The total number of data packets received by the destination node per second.

iii. **Routing overhead:** The total number of routing packets which are transmitted during the simulation time. For packets sent over multiple hops, each transmission of the packet counts as one transmission.

iv. **Average number of dropped packets:** This gives the total number of data packets dropped during the communication in the networks.

v. **Speeds of the mobile nodes:** Testing the behavior of the developed routing protocols under different and random speeds of nodes that varies between 0 and 30 meter in second. In the simulation environment the speed of mobile nodes varies between 0 to 30 m/sec.

vi. **Pause time:** changing pause time means to increase the randomness in the nodes behavior. In the simulation environment the pause time values varies between 0 to 30 second.

vii. **Energy consumption level:** It keeps the energy level of node which is spent for sending and receiving a data to the total energy spent on the network.

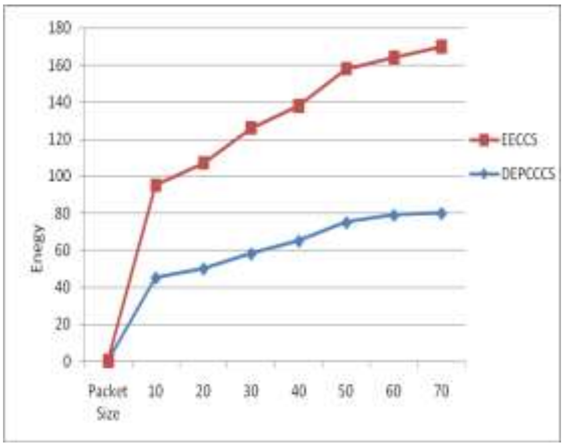

Figure 1: Packet Size Vs Energy

Fig. 1 shows that the energy level of networks using DEPCCCS and EECCS decreases significantly when the number of packets increases rapidly whilst that of DEPCCCS based network shows stability with Decreasing Energy.

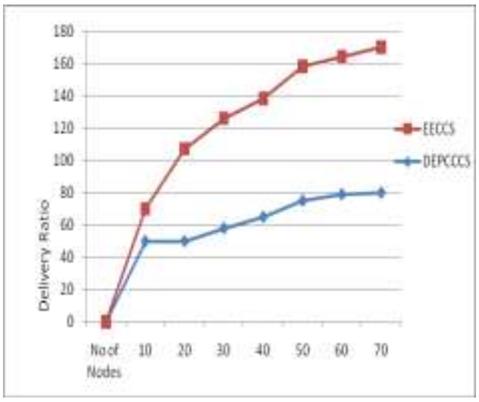

Figure 2: No of Nodes Vs Delivery Ratio

Fig. 2 shows that the Delivery Ratio of networks using DEPCCCS and EECCS when the number of nodes exceeds . On the contrary, the delivery ratio high in the EECCS method rapidly whilst that of DEPCCCS based network shows decrease the delivery Ratio.

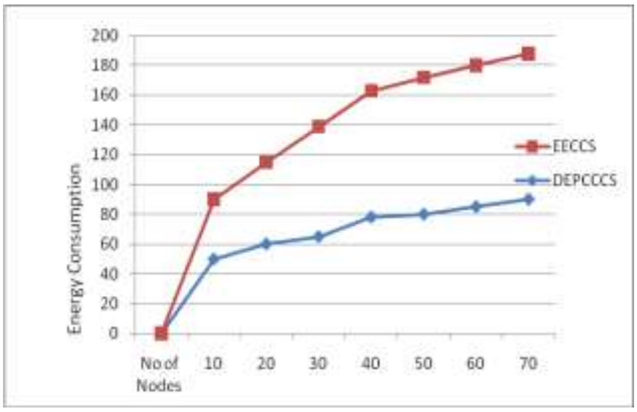

Figure 3: No of Nodes Vs Energy Consumption

Fig 3 shows the energy consumption when rapidly increases the no of nodes in the mobile ad hoc network significantly the energy consumption high but in the DEPCCCS, energy consumption level compare to existing system its reduce

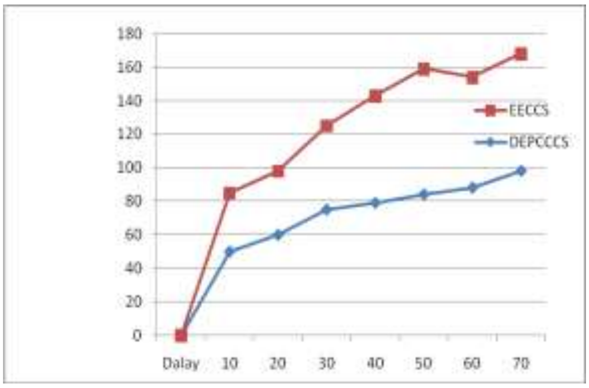

Figure 4: Delay Vs Throughput

Fig. 5 shows the results of throughput for varying the delay 10 to 70. From the results, we can see that DEPCCC scheme has higher throughput than the EECCS because of congestion aware routing and monitoring.

Conclusion

This research focused mainly on challenges in the MANET efficiency, power consumption, congestion control and the

Existing and proposed routing algorithms and its properties are analyzed. the Dynamic Efficient Power Consumption Congestion Control Scheme (DEPCCCS) for congestion control and improving the quality of service in mobile network for multicasting in mobile ad-hoc networks (MANETs) is proposed.

DEPCCCS scheme overcomes the disadvantages of existing multicast congestion control schemes. This scheme has very limited control traffic overhead and delay and consume minimum energy. Moreover, the proposed scheme does not impose any significant changes on the queuing, scheduling or forwarding policies of existing networks.

Simulation results have shown that our proposed method has better delivery ratio and throughput with less delay and energy consumption, minimum power when compared with existing method and the performance is better than existing multicast congestion control protocols. This research work concluded that DEPCCCS for multicasting in mobile ad-hoc networks works far better than existing congestion control scheme and its giving more lifetimes to the network.

REFERENCES

1. Raj Jain " Congestion Control in Computer Networks : Issues and Trends" May 1990 - IEEE Magazine.
2. Y. B. Ko, and N. H. Vaidya, "Location-Aided Routing (LAR) in mobile ad hoc networks" in Proc. 4th annual ACM/IEEE international conference on Mobile computing and networking, 1998.
3. KartikChandran,Sudarshan Raghunathan, Subbarayan Venkatesan, Ravi Prakash, "A Feedback-Based Scheme for Improving TCP Performance in Ad Hoc Wireless Networks", IEEE Personal Comsmunications, February 2001.
4. T. Camp, J. Boleng, B. Williams, L. Wilcox, and W. Navidi, "Performance comparision of two location- based routing protocols for ad hoc networks", in Proc. IEEE INFOCOM, 2002, p. 1678-1687
5. H. Hussein, A. O. Abu Salem, and S. Yousef, ''A flexible weighted clustering algorithm based on battery power for mobile ad hoc networks,'' in Proc. IEEE Int. Symp. Ind. Electron., Jun./Jul. 2008, pp. 2102–2107.
6. Xuyang Wang and Dmitri Perkins, 2008. "Cross-layer Hop-by-hop Congestion Control in Mobile Ad Hoc Networks", Proc., IEEE, wireless communication and networking conference (WCNC), pp 2456 – 2461.
7. Anuj K. Gupta, Harsh Sadawarti, and Anil K. Verma, "Review of Various Routing Protocols for MANETs", International Journal of Information and Electronics Engineering, Vol. 1, No. 3, November 2011.
8. S. Mishra, I. Woungang, and S. C. Misra, ''Energy efficiency in ad hoc networks,'' Int. J. Ad Hoc, Sensor Ubiquitous Comput., vol. 2, no. 1, pp. 139–145, 2011.
9. V. Thilagavathe, Dr. K. Duraiswamy, "Cross Layer based Congestion Control Technique for Reliable and Energy Aware Routing in MANET". International Journal of Computer Applications (0975 – 8887) Volume 36– No.12, December 2011.
10. S.A.Jain and Sujata K.Tapkir, "A Review of Improvement in TCP congestion Control Using Route Failure Detection in MANET", Network and Complex Systems www.iiste.org ISSN 2224-610X (Paper) ISSN 2225-0603 (Online) Vol 2, No.2, 2012.
11. "Dynamic congestion detection and control routing in ad hoc networks",T. Senthilkumaran V. Sankaranarayanan 1319-1578,2012 King Saud University.
12. K.Srinivasa Rao, R.Sudhistna Kumar, P. Venkatesh, R.V.Sivaram Naidu, A.Ramesh/ International Journal of Engineering Research and Applications (IJERA) Vol. 2, Issue 2,Mar-Apr 2012, pp.631-634 "Development of Energy Efficient and Reliable Congestion Control Protocol for Multicasting in Mobile Adhoc Networks compare with AODV Based on Receivers "
13. Md. Imran Chowdhury, Asaduzzaman, Mir. Md. Saki Kowsar, "An Energy Efficient and Cooperative Congestion Control Protocol in MANET ". International Journal of Computer Applications (0975 – 8887) Volume 58– No.17, November 2012.
14. S. Sound. et al. "Ant Based Multi-path Routing for Load Balancing and Congestion Control in MANETs" Journal of Information & Computational Science 9: 12 (2012) 3365–3377.
15. S. Subburam Research Scholar, P. Sheik Abdul Khader, "Predictive congestion control mechanism for MANET".Indian Journal of Computer Science and Engineering(IJCSE)ISSN : 0976-5166 Vol. 3 No.5 Oct-Nov 2012.
16. S.Rajeswari, Dr.Y.Venkataramani "Congestion Control and QOS Improvement for AEERG protocol in MANET", International Journal on AdHoc Networking Systems (IJANS) Vol. 2, No. 1, January 2012
17. Vishnu Kumar Sharma and Dr. Sarita Singh Bhadauria, "Mobile Agent Based Congestion Control Using Aodv Routing Protocol Technique For Mobile Ad-Hoc Network", International Journal of Wireless & Mobile Networks (IJWMN) Vol. 4, No. 2, April 2012.
18. Prof. S.A. Jain, Mr. Abhishek Bande, Mr. Gaurav Deshmukh, Mr. Yogesh Rade, Mr. Mahesh Sandhanshiv, "An Improvement In Congestion Control Using Multipath Routing In Manet", International Journal of Engineering Research and Applications (IJERA).
19. Aarti et al., "Study of MANET: Characteristics, Challenges, Application and Security Attacks" International Journal of Advanced Research in Computer Science and Software Engineering 3(5), May - 2013, pp. 252-257 © 2013, IJARCSSE All Rights Reserved
20. A.Venkataramana and S.Pallam Shetty, Ph.D "Impact of MAC Layer on AODV and LAR Routing Protocols in MANETs" International Journal of Computer Applications (0975 – 8887) Volume 84 – No 4, December 2013.
21. S.Sheeja, Dr.Ramachandra.V.Pujeri, "Effective Congestion Avoidance Scheme for Mobile Ad Hoc Networks". I. J. Computer Network and Information Security, 2013, 1, 33-40 Published Online January 2013 in MECS Copyright © 2013 MECS
22. Dr. M .Rajanbabu, Ms .A.R .Sushma, Ms. B.S.Sowjanya,Mr. B .Suresh kumar, Ms. B. Tejaswini, "Qos Parameters of an Energy Efficient Multicast Congestion Control Protocol (Eemccp) Over Fading Channels". ISSN: 2278-0661, p- ISSN: 2278-8727Volume 16, Issue 2, Ver. III (Mar-Apr. 2014), PP 72-80 www.iosrjournals.org.
23. M.Sunitharani,Mr.M.L.Ravic Handra, "Low Overhead Energy Efficient Hierarchical Congestion Control Multicast routing for MANET". International Journal of

Advanced Research in Computer and Communication Engineering Vol. 3, Issue 3, March 2014.

24. S.Sheeja, Dr. Ramachandra V Pujeri Research Scholar, Bharathiar University, Coimbatore. “Efficient Energy Based Congestion Control Scheme For Mobile Ad Hoc Networks”. Journal of Theoretical and Applied Information Technology 10th June 2014. Vol. 64 No.1

25. Ashish Kumar Mourya1, Niraj Singhal,“ Managing Congestion Control In Mobile Ad-Hoc Network Using Mobile Agents” International Journal of Computer Engineering & Applications, Vol. IV, Issue I/III

26. Som Kant Tiwari, Dr. Y.K. Rana, Prof. Anurag Jain, “An ECN Approach to Congestion Control Mechanisms in Mobile Ad hoc Networks”, Network and Complex Systems www.iiste.org ISSN 2224-610X (Paper) ISSN 2225-0603 (Online) Vol.4, No.6, 2014.

27. “Low-Latency Video Streaming with Congestion Control in Mobile Ad- Hoc Networks”. Claudio Greco, Member, IEEE, Marco Cagnazzo, Senior Member, IEEE, and Be´atrice Pesquet-Popescu, Senior Member, IEEE.