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Proposed Hybrid Congestion Control Algorithm (HCCA) Using Mobile Adhoc Network

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Abstract - A mobile ad hoc network (MANET) is a group of mobile, wireless nodes which helpfully and unexpectedly structure an IP-based network. Nodes that are a piece of the MANET, yet past one another's wireless range impart utilizing a multi-hop course through different nodes in the network. The decision of scheduling process which queued packet to process next will significantly affect the general end-to-end execution when traffic load is high. There are a few scheduling strategies for different network situations. It is seen that totally lowering the delays isn't for all intents and purposes conceivable, nonetheless, delays can be controlled to go past certain threshold range. Hybrid Congestion Control is employed to minimize congestion in MANETs through optimal data handling. The proposed model in our work is an innovative method to manage congestion alongside reduction in time taken for transmission.

Keywords: MANET, Hybrid, Congestion, QOS, Transmission.

1. INTRODUCTION

The network community has made active contributions in designing and modification of congestion control approaches, particularly with regards to high speed congestion control. In the time of Internet, the vast majority of the applications are network driven which requires immense measure of data transfer among the network devices. The primary driver of this drastic change in Internet environment is because of the emergence of new real time applications and large scale distributed scientific computations utilizing grid environment. Notwithstanding that, blast of smart phones, tablets and multimedia traffic in Internet draws out a one of a kind arrangement of difficulties for network congestion management. Overseeing network congestion in such high demanding and dynamic environment has their own issues.

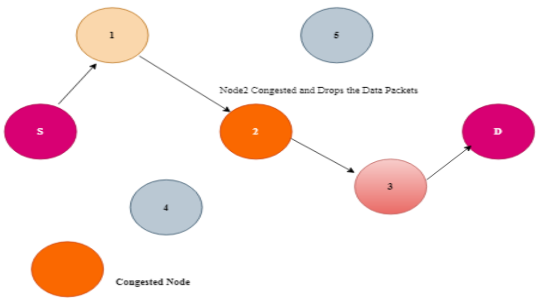

Fig -1: Up-Stream Congestion Node

Figure 1 determines a route S->1->2->3- - > D, the route is at first found for the sender S to the receiver D, the node 2 has blocked due to buffer overflow, it couldn't process every single incoming packet so it drops all the packets. Just expanding the physical channel capacity, present higher data rate connections or introduce faster transceiver won't be sufficient. It is accordingly imperative to put forth an engaged research attempt to beat existing troubles of congestion management to guarantee a robust future Internet. Another generation of high speed data networks is being conveyed the world over to empower coordinated effort between widespread research bunches through the sharing of computing resources. High speed wired networks are described by higher bandwidth, large queuing delay and high burstiness and may convey heterogeneous traffic flows with assorted QoS requirements. These attributes make it significantly all the more testing to efficiently deal with the congestion problem. So as to control congestion and efficiently use the large bandwidths at the physical layer, research community have concentrated on the improvements of protocols at transport and network layers for high speed networks. At transport layer end-to-end methods implemented in TCP are utilized for congestion control. The Congestion control methods utilized by the conventional TCP isn't relevant to the current high-speed long delay networks because of quick increment of link bandwidth. The packet drop rate requirement for full use of long bandwidth-delay link isn't feasible by the customary TCP. Large quantities of congestion control methods for high speed networks, utilized by TCP, have been proposed. These high-speed TCP's are efficient in using the high bandwidth link. Still there are more current issues and difficulties have been emerged during design and implementation of these high-speed TCP's. Friendliness, fairness, responsiveness and convergence are a portion of the significant design and implementation issues for high speed TCP that require genuine consideration.

2. CONGESTION LEVELS

Four congestion levels are expected, in particular low congestion, high congestion, moderate congestion, and critical congestion. The nodes will carry on as portrayed below as per which level they have a place with:

Low Mode: Truth be told, in this state there is no congestion in the network and the intermediate node sends packets ordinarily. Low congestion in the proposed technique was acquainted all together with think about all situations in the model. Nothing will occur for controlling congestion.

Moderate Mode: In this state, the nodes experience a little congestion. To stay away from congestion in the network, the blocked node announces a warning message to 1/2 its upstream nodes to locate another alternative route for packet transmission.

High Mode: In this state, the intermediate nodes endure high congestion and the clogged node announces a warning message to 2/3 its upstream nodes to locate another process.

Critical Mode: In this state, the congestion level is too high and the intermediate node that suffers from congestion announces to the source node to locate another alternative route and reduces its transmission rate.

Diagnosis and management of congestion prompts expanded network performance. On the off chance that nodes are considered as far as their behavior, the congestion problem can be tackled as a behavioral problem. A behavioral model of congestion at the nodes assists with adjusting the behavior of nodes. At whatever point congestion happens in the network, nodes change their attitude towards other neighbor nodes and network nodes and in case of serious congestion situations, they have particular behaviors from an earlier time.

3. PROPOSED HYBRID PROTOCOL MODEL

In this proposed model packet loss in view of congestion and over the top load at intermediate nodes is attempted to be diminished. Balancing load to maintain a strategic distance from congestion inside novel scheme of stream control is truly performed by making a cycle on a hub where the congestion probability is high i.e. at close to sink node to find every one of those nearer nodes where buffer occupancy is high.

It contains address of nearer neighbor nodes, distance between the nodes, and queue length of every node as appeared in Figure 2. The dynamic idea of wireless sensor organize cause the topology to automatically change because of progress in topology every node automatically refreshes its data in its own routing table and the routing table of the closer hub with respect to its buffer length, its good ways from various nodes, its I.P address.

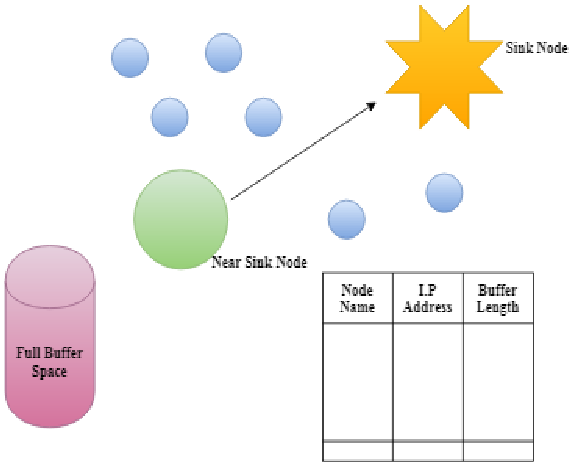

Fig -2: Congestion Affected Node

There are following steps to be followed during this process:

1. Firstly a proactive/table driven algorithm is applied to discover the path from source node to destination node. In the event that path is without congestion than data packets are conveyed as such after the characterized route.

2. This algorithm check's the routing table of congestion affected node to discover all the nodes closer to it with minimum response length time for example it must have maximum buffer inhabitance to oblige the heap

3. In the wake of finding the node with free buffer space Hop-by-Hop algorithm make that node as the kid node of the congestion affected node and the alternate routes from the congestion affected node to the closer node will get dynamic to transmit data to use its buffer space.

4. When the time period during which kid node gets the packets in its buffer space from the congestion affected parent node it will store them in its buffer for a brief timeframe span.

5. On receiving the packets from congestion affected node by the closer node at the same time this node will quickly actualize the Hop-to-Destination algorithm to propel the packets to the destination for example sink node base station inside the limited measure of time.

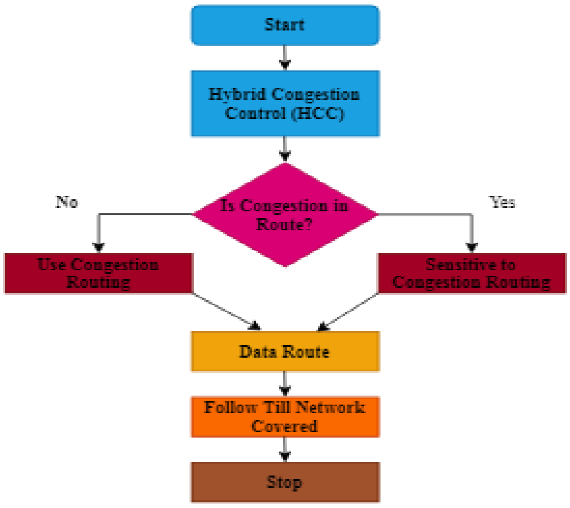

Fig -3: Proposed Workflow

1. Hybrid Congestion Control is best for little to medium size networks. As the system size increases the performance of Hybrid Congestion Control algorithm diminishes. To defeat this problem in our approach nodes are done to switch to follow IAODV as system develops and probability of congestion increases. Accordingly performance can be improved even with huge networks.

2. Route from source to destination, simply the congestion influenced node needs to discover new path.

3. Another distinct favorable position of our model as compared to Hybrid Congestion Control is that packet dropping rate is reduced. In this way maximum packet delivery fraction can be achieved.

4. This proposed model attempts to maximize the utilization of free nodes and there buffer space. Hence optimization of system resources can be achieved.

5. Another bit of leeway of this model is reduction of end to end delay.

4. PROPOSED HYBRID CONGESTION CONTROL ALGORITHM

In this algorithm, the transmitter node sends a route request message to every single nearby node. In this way, the receiver chooses this path as its own primary path. The procedure of this algorithm is that when a node starts sending information packets to the network, because of the increased transmission rate and buffer fullness, the nodes begin to discard packets. On the off chance that there is no control over congestion at the intermediate nodes, packets will move from the sender to the receiver by using the primary route. Since mobility is moderately lower than the packet forwarding rate, this sending technique causes congestion at the intermediate nodes. In this manner, our congestion control scheme starts by changing a few parameters referenced in what follows. In this mechanism, changing the route or changing the transmission rate depends on the information sent to the intermediate node or the source node. This information is placed into the ACK packet in a message. At that point, these packets dependent on the congestion level read the accessible information in the media access layer before they are sent to the higher layer. On the off chance that the packet contains commands to change the route, the nodes start another route discovery procedure and expel the current path. On the off chance that the packet contains commands to change the path just as the transmission rate, the packet is conveyed to the following node with the goal that it is sent to the source node for decreasing the transmission rate.

Step 1: The source sends the data packets to the destination through the intermediate nodes.

Step 2: Queue Length (LQ) is defined using percentage channel utilization time t.

Step 3: Upon reception of the data packets, the intermediate node verifies both the queue length and channel utilization, and further assigns a value to Congestion Bit (C_b) as per the following cases.

If $L_Q > LQ_{th}$ and $CU > CU_{th}$ Then

Set $C_b = 1$

End If

If $L_Q > LQ_{th}$ and $CU = CU_{th}$ Then

Set $C_b = 0$

End If

The nodes on a connection path can assume a vital role in determining the congestion state of the network, as they are in where the congestion really happens. In request to maintain congestion control for the information change process, the intermediate nodes on the path from the sender to the receiver calculate the rate information and this is propagated as a feedback by the receiver. The intermediate node stamps the rate feedback dependent on the current queue length in the options field of passing the packet's IP header. As the intermediate nodes are liable for dropping packets when there is congestion in the network, they ought to react to such situations. With the rate based approach proposed in this part, the intermediate nodes will give the feedback through inserting the rate information into the passing packets. Thus, the performance degradation brought about by the radical change in the sending rate, is reduced. The sender node changes its information dispatch by the rate feedback from the intermediate nodes, using the rate based approach.

5. EXPERIMENTAL RESULTS

Re-Transmission Time

Table -1: Comparison Table of Re-Transmission Time (m.secs) Ratio

Optimized Link State Routing Technique(OLSR)	Energy Efficient Neighbor Coverage Protocol (EENCP)	Proposed Hybrid Congestion Control(HCC)
13	22	7
18	27	15

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21	**35**	**20**
24	**44**	**22**
30	**51**	**26**

The comparison table 1 Re-Transmission Time clarifies the benefits of Existing 1 Optimized Link State Routing Technique (OLSR), Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) and Proposed Hybrid Congestion Control (HCC). Existing 1Optimized Link State Routing Technique (OLSR) explains the Re-Transmission Time values are from 13 to 30, Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) values are begins from 22 to 51 and Proposed Hybrid Congestion Control (HCC) strategy values are begins from 7 to 26. The Proposed Hybrid Congestion Control (HCC) strategy demonstrates the better outcomes.

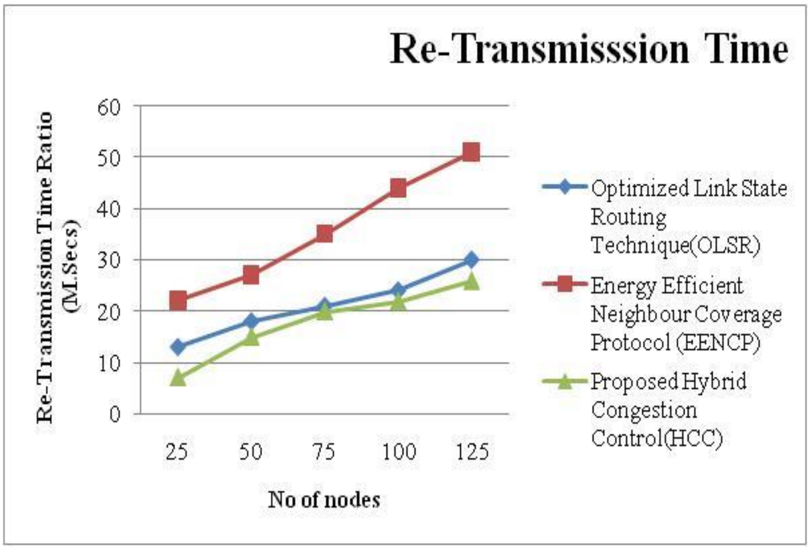

Fig -4: Comparison chart of Re-Transmission Time (m.secs) Ratio

Figure 4 demonstrates the comparison of Re-Transmission Time Ratio. Existing 1 Optimized Link State Routing Technique (OLSR) explains the Re-Transmission Time values are from 13 to 30, Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) values are begins from 22 to 51 and Proposed Hybrid Congestion Control (HCC) strategy values are begins from 7 to 26. These results are simulated using NS2 simulator. This result shows a consistent result for proposed novel process. Hence the proposed method produced a better improvement re-transmission time ratio results.

Node Power Level Variance

Table -2: Comparison Table of Node Power Level Variance Ratio

Optimized Link State Routing Technique(OLSR)	Energy Efficient Neighbor Coverage Protocol (EENCP)	Proposed Hybrid Congestion Control(HCC)
67.2	83	57
69.7	84.8	59
67.8	87.9	62
72.6	70.2	66
75	93.6	69

The comparison table 2 of Node Power Level Variance clarifies the benefits of Existing 1 Optimized Link State Routing Technique (OLSR), Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) and Proposed Hybrid Congestion Control (HCC). Existing 1 Optimized Link State Routing Technique (OLSR) explains the Node Power Level Variance values are from 67.2 to 75, Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) values are begins from 83 to 93.6 and Proposed Hybrid Congestion Control (HCC) strategy values are begins from 57 to 69. The Proposed Hybrid Congestion Control (HCC) strategy demonstrates the better outcomes.

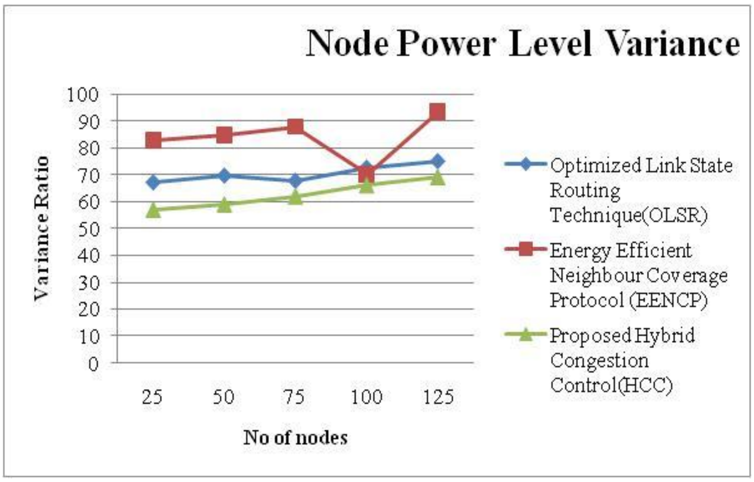

Fig -5: Comparison chart of Node Power Level Variance Ratio

Figure 5 demonstrates the comparison of Node Power Level Variance Ratio. Node Power Level Variance Ratio is defined as called statistically significant if it is deemed unlikely to have occurred by chance, assuming the truth of the null hypothesis. Existing 1 Optimized Link State Routing Technique (OLSR) explains the Node Power Level Variance values are from 67.2 to 75, Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) values are begins from 83 to 93.6 and Proposed Hybrid Congestion Control (HCC) strategy values are begins

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from 57 to 69. These results are simulated using NS2 simulator. This result shows a consistent result for proposed novel process. Hence the proposed method produced a better improvement Node Power Level Variance Ratio results.

Routing Overhead Ratio

Table -3: Comparison Table of Routing Overhead Ratio

Optimized Link State Routing Technique(OLSR)	Energy Efficient Neighbor Coverage Protocol (EENCP)	Proposed Hybrid Congestion Control(HCC)
75	55	33
68.9	58.6	39
83.86	62.3	42
70.21	68.9	48.6
92.06	72	50.76

The comparison table 3 Routing Overhead Ratio clarifies the benefits of Existing 1 Optimized Link State Routing Technique (OLSR), Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) and Proposed Hybrid Congestion Control (HCC). Existing 1 Optimized Link State Routing Technique (OLSR) explains the Routing Overhead Ratio values are from 75 to 92.06, Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) values are begins from 55 to 72 and Proposed Hybrid Congestion Control (HCC) strategy values are begins from 33 to 50.76. The Proposed Hybrid Congestion Control (HCC) strategy demonstrates the better outcomes.

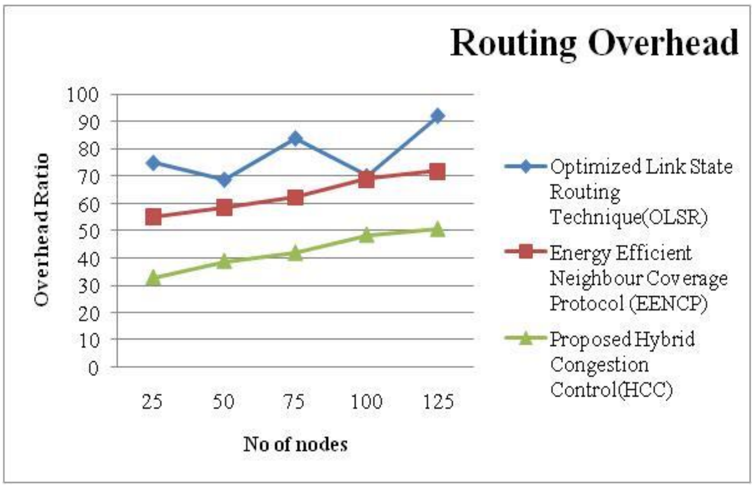

Fig -6: Comparison chart of Routing Overhead Ratio

Figure 6 demonstrates the comparison of Routing Overhead Ratio. Routing Overhead Ratio is defined as routing and data packets have to share the same network bandwidth most of the times, and hence, routing packets are considered to be an overhead in the network. Existing 1 Optimized Link State Routing Technique (OLSR) explains the Routing Overhead Ratio values are from 75 to 92.06, Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) values are begins from 55 to 72 and Proposed Hybrid Congestion Control (HCC) strategy values are begins from 33 to 50.76.These results are simulated using NS2 simulator. This result shows a consistent result for proposed novel process. Hence the proposed method produced a better improvement Routing Overhead Ratio results.

Routing Power Ratio

Table -4: Comparison Table of Routing Power Ratio

Optimized Link State Routing Technique(OLSR)	Energy Efficient Neighbor Coverage Protocol (EENCP)	Proposed Hybrid Congestion Control(HCC)
31.9	26.77	39
37.7	31.98	45
42.6	34.56	49
50.4	38.92	55
55.23	44.56	58

The comparison table 4 Routing Power Ratio clarifies the benefits of Existing 1 Optimized Link State Routing Technique (OLSR), Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) and Proposed Hybrid Congestion Control (HCC). Existing 1 Optimized Link State Routing Technique (OLSR) explains the Routing Overhead Ratio values are from 31.9 to 55.23, Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) values are begins from 26.77 to 44.56 and Proposed Hybrid Congestion Control (HCC) strategy values are begins from 39 to 58. The Proposed Hybrid Congestion Control (HCC) strategy demonstrates the better outcomes.

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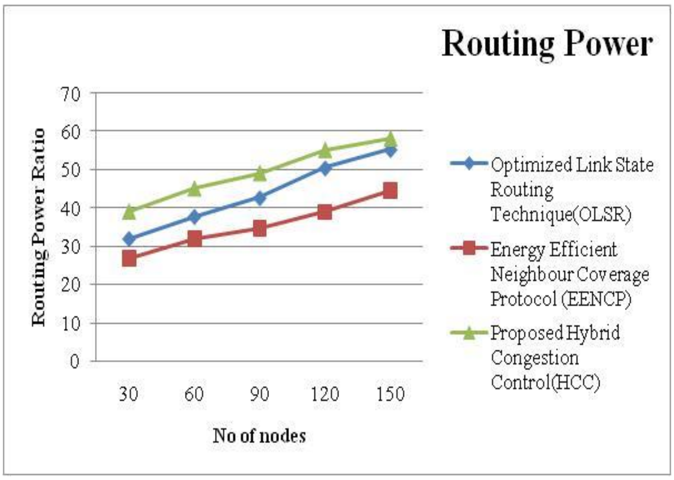

Fig -7: Comparison chart of Routing Power Ratio

Figure 7 demonstrates the comparison of Routing Power Ratio. Routing Power Ratio is defined as a calculation commonly applied to engines and mobile nodes, packets *power* sources to enable the comparison of one unit or design to another. Existing 1 Optimized Link State Routing Technique (OLSR) explains the Routing Overhead Ratio values are from 31.9 to 55.23, Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) values are begins from 26.77 to 44.56 and Proposed Hybrid Congestion Control (HCC) strategy values are begins from 39 to 58.These results are simulated using NS2 simulator. This result shows a consistent result for proposed novel process. Hence the proposed method produced a better improvement Routing Power Ratio results.

Energy Consumption Ratio

Table -5: Comparison table of Energy Consumption Ratio

Optimized Link State Routing Technique(OLSR)	Energy Efficient Neighbor Coverage Protocol (EENCP)	Proposed Hybrid Congestion Control(HCC)
0.682	0.41	0.8
0.693	0.47	0.83
0.71	0.53	0.85
0.73	0.55	0.89
0.75	0.57	0.91

The comparison table 5 Energy Consumption Ratio clarifies the benefits of Existing 1 Optimized Link State Routing Technique (OLSR), Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) and Proposed Hybrid Congestion Control (HCC). Existing 1 Optimized Link State Routing Technique (OLSR) explains the Energy Consumption Ratio values are from 0.682 to 0.75, Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) values are begins from 0.41 to 0.57 and Proposed Hybrid Congestion Control (HCC) strategy values are begins from 0.8 to 0.91. The Proposed Hybrid Congestion Control (HCC) strategy demonstrates the better outcomes.

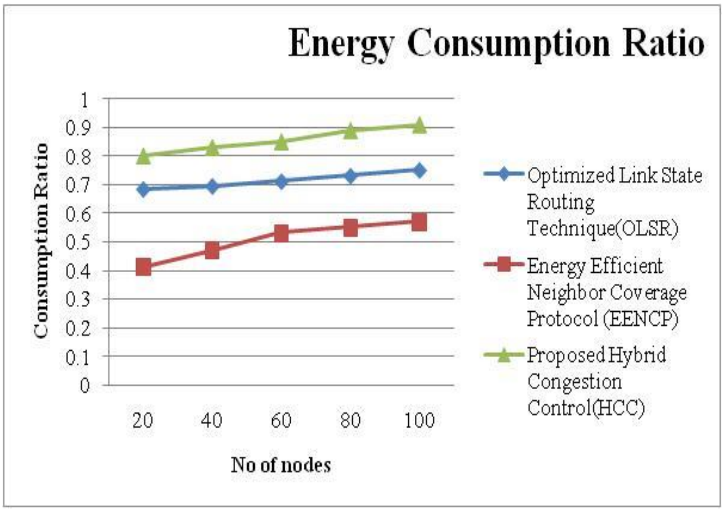

Fig -8: Comparison chart of Energy Consumption Ratio

Figure 8 demonstrates the comparison of Energy Consumption Ratio. Energy Consumption Ratio is characterized as comprise of low power gadgets that are circulated in geologically separated regions. The energy consumption is a significant worry for WSN. An enhancement way to deal with lessen the energy consumption and expand the network lifetime. Existing 1 Optimized Link State Routing Technique (OLSR) explains the Energy Consumption Ratio values are from 0.682 to 0.75, Existing 2 Energy Efficient Neighbor Coverage Protocol (EENCP) values are begins from 0.41 to 0.57 and Proposed Hybrid Congestion Control (HCC) strategy values are begins from 0.8 to 0.91. These results are simulated using NS2 simulator. This result shows a consistent result for proposed novel process. Hence the proposed method produced a better improvement Energy Consumption Ratio results.

6. CONCLUSIONS

In this chapter, proposed Hybrid Congestion Control is employed to minimize congestion in MANETs through optimal data handling. The proposed model in our work is an innovative method to manage congestion alongside reduction in time taken for transmission. This proposed model is efficient for using the network resources in an optimized way by distributing load among buffers of neighboring nodes of congestion influenced node while at the same time decreasing end to end delay. Comparison of results reveals that the proposed technique alleviates congestion effectively than other algorithms, at the same time decreases delay and improves throughput.

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