Improving Mobile Ad Hoc Network Performance Using Data Mining Approach

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***Abstract*—**Mobile ad hoc network have various open issues and challenges for research and development. In this presented work the efficient route selection is a key area of investigation and solution design. In this context network is basically suffers from availability of routing nodes and their workload. The overloaded nodes in network are not efficient for utilizing high speed communication. Therefore a route selection process is required that offers best path among the various routes available between source and destination. The proposed approach introduces a data mining technique to obtain such efficient node. Therefore the technique involves the study of K-nearest nearest neighbor classifier for classifying the best route. In a basic process sequence first a buffer utilization threshold is need to compute which is used to label each node of the routing path. After labeling of the route nodes the KNN search process that finds most fit sequence of route node is performed. The proposed approach is efficient and promising for discovering optimal route among two communicating nodes. The proposed concept is implemented over the AODV routing technique which is available on NS2 network simulator. After that the comparative performance is also evaluated with AODV routing technique. To perform comparative study PDR, energy consumption, throughput, end to end delay and the routing overhead is preferred as the key parameters. The simulation result shows that the proposed approach is outperform as compared to traditional technique.

Keywords-MANET, efficent routing, buffer management, load balancing, survey on buffer management

I. INTRODUCTION

A remote system enables versatile clients to convey without a physical association, for example, a link. Remote systems now offer high information rates and unwavering quality requiring little to no effort. This has prompted a quick and across the board increment in their utilization lately. In this exhibited work the versatile impromptu system is key territory of study. The portable impromptu system is a completely associated remote system which chips away at the premise of their steering technique. The directing convention is essentially intended for finding the courses among two conveying hubs in arrange furthermore of to keep up the course amid various types of network issues. As we realize that the system is completely remote and versatile subsequently the system is experiences different execution issues. In this setting another procedure of steering is proposed in this work.

The principle point of the proposed work is to enhance the conventional directing system for enhancing the capacity of information conveyance. In this setting the productive and steadier courses are required to get. In this setting an information digging approach is proposed for finding the most proper course among the accessible conceivable courses amongst source and goal. Along these lines the proposed method is consolidated with course disclosure procedure of the steering convention and for finding the most appropriate course the KNN (k-closest neighbor) calculation is utilized with the directing convention. The proposed approach is promising methodology for finding the best way among accessible courses.

II. PROPOSED WORK

The proposed work of routing protocol enhancement for finding efficient route using the data mining technique is explained in detail in this chapter. Therefore first the overview of the proposed routing protocol is proposed and then a suitable algorithm is provided for understanding of the process.

A. System Overview

The mobile ad hoc network is an organization of Wi-Fi nodes these nodes are communicating using the wireless links. Therefore the mobility in network is a key property, but due to mobility every node can move independently in the network area. In addition of that the network nodes are dynamically establish routes for communication therefore the routing played essential role in ad hoc network communication. But these routes are dependent on positioning of nodes and if an intermediate node changes their position then route become abounded. In addition of that different other mobility factors are affecting the performance of network such as high load on nodes. Therefore in this presented work an optimal route selection technique is proposed for finding most efficient route among available routes.

The proposed technique is based on routing strategy on which the KNN (k-nearest neighbor) algorithm is applied for evaluation of existing path. The evaluation of routes is performed during the route establishment or the route discovery phase. Therefore it is promising to provide effective route among source and destination. The proposed routing techniques first find all the possible routes among source and destination. After that a threshold value is used for labeling of each router in terms of efficiency. Finally the KNN algorithm is implemented to evaluate and classify most efficient route among the available routes. The proposed approach is tried to implement under the AODV routing protocol. This section delivers the basic overview of the proposed concept of routing protocol improvement on the basis of overloaded node classification using data mining technique. The next section provides the detailed solution design methodology.

B.Methodology

The target of the proposed routing protocol design is to obtain the efficient route among source and destination. In this context it is required to find the route having less workload by which the available bandwidth is higher and can deliver packets in higher rate. In order to check the route a key parameter is assumed namely buffer of node. Basically the buffer is a fixed amount of memory which is used to store the data during active communication. In this context when the node frequently works for communication the buffer length is consumed. For example if we assumed that the node has 100% free buffer during normal condition and for each connection handling 40% of buffer memory is required then the only two nodes can communicate with the node simultaneously and if third node is also want to make connection with it then the communication leads to be delay or causes packet loss. Therefore in order to prevent the network from such kind of losses a new model is introduced the function aspect of the proposed methodology is described as:

Threshold Estimation

In order to estimate the threshold for the network, first a network model is prepared that is deployed in ideal scenarios with the mobility and multiple communication session. During these experiments each node compute the buffer consumed during each communication session. After that the mean buffer consumption value is utilized to define the network buffer threshold. In this context let if the network has N node such that $N = \{N_1, N_2, \dots, N_n\}$ and during the communication sessions these nodes consume buffer as $B = \{B_1, B_2, \dots, B_n\}$. Then the buffer threshold is computed using the following formula. This buffer threshold value is used to evaluate the workload criticalness in a node during evaluation.

$$B_{thr} = \frac{1}{N}\sum_{i=1}^{N} B_i$$

Where N is the number of nodes, B is the buffer level used by the node and B_{thr} is the threshold buffer length.

K-nearest Neighbor algorithm

The K-nearest-neighbor (KNN) algorithm finds distance between a query and a set of data base scenarios. The distance between these scenarios is estimated using a distance function$D(x, y)$, where x and y are vectors developed through features.

$$x = \{x_1, x_2, x_3, \dots\}$$

$$y = \{y_1, y_2, y_3, \dots\}$$

There are two frequently used distance functions are absolute distance and Euclidean distance. The absolute distance is calculated using:

$$D(x, y) = \sum_{i=1}^{N} |x_i - y_i|$$

And Euclidean distance can computed using:

$$D(x, y) = \sum_{i=1}^{N} \sqrt{x^2 - y^2}$$

The KNN algorithm includes the following steps to process the data:

1. Take M to Data base scenario and a query scenario Q in vector $R = \{r_1, r_2, \dots, r_m\}$ and evaluate by repeating a loop M times:
    a. Select a scenario S_i from data set, where i is current iteration
    b. If Q is not set or R < d (R, S_i): R ←d (R, S_i), t ←O_i

c. Loop until end of data set.

d. Store R into vector c and t into vector R.

2. Calculate the mean output across R:

$$\bar{R} = \frac{1}{M}\sum_{i=1}^{M} R_i$$

3. Return R for query q

Evaluation of route

Now both the components which are defined in the previous sections are used with the routing protocol for selecting the best optimal path among available. Therefore first the sender node sends the RREQ (route request packet) to destination and waits until all the possible replies are not obtained. When all the possible replies are obtained from the destination node the evaluation of route is initiated. In order to understand this process let an example. Consider the table 2.1 which contains two routes between Source router S and destination D.

S. No.	Route sequence R_M	No of Hops H_N
1	S, A, E, C, D	4
2	S, A, B, F, G, D	5

Table 2.1 example routes

Now for each route sequence the threshold is used to label the sequence as the 0 or 1. The route node is labeled with 0 if the available buffer of the node is lower than the estimated threshold else it is denoted using 1. Now the KNN algorithm is employed for finding the route sequence that contains maximum 1 in their sequence.

C. Proposed Algorithm

This section provides the concluded steps of the proposed routing technique for obtaining the efficient route between source and destination.

Input: network with the N nodes, Threshold buffer length B_{thr}

Output: optimal Route R

Process:

1. Sender broadcast route request RREQ
2. Sender Wait for replay RREP message
3. For each reverse route RS in source routing table
    a. $for(i = 1; i < H_n; i++)$
        i. $if(B_i < B_{thr})$
            1. $assign$ 0
        ii. Else
            1. Assign 1
        iii. End if
    b. End for
4. End for
5. Q = createKNNQuery(H_n)

6. $R = KNN.search(Q, RS)$
7. Return R

Table 2.2 proposed algorithm

The R is the optimal route which contains maximum nodes which have the buffer higher then threshold buffer.

III. SIMULATION

This section explains the proposed technique's simulation setup parameters and the scenarios of experiments.

A. Network Simulation Setup

In this section the required network configuration of the proposed approach implementation is described. In addition of their parameters and the required values are also reported. The table 3.1 contains the network setup parameters and their description.

Simulation properties	**Values**
Antenna model	Omni Antenna
Simulation area	750 X 550
Radio-Propagation Model	Two Ray Ground
Channel Type	Wireless Channel
No of Mobile Nodes	20, 40, 60, 80, 100
Routing Protocol	AODV/PROPOSED

Table 3.1 Network Simulation Setup

B. Simulation Scenario

This section provides the understanding about the simulation scenarios under which the experiments are performed. To demonstrate the security technique their two key simulation scenarios are proposed in this section. Both the simulation scenarios are conducted with different number of nodes that are 20, 40, 60, 80 and 100 nodes.In order to perform the experiments the following investigational scenarios are demonstrated in this section.

1. **Simulation of traditional AODV Routing:** In this phase the network is configured with the help of AODV for buffer management using different number of nodes that experiments are performed. During the experiments different performance parameters are computed and their comparative study is performed with proposed approach. The traditional network is demonstrated using figure 3.1. In this simulation process, node 0 and node 9 indicating source and sink node respectively with blue colour.

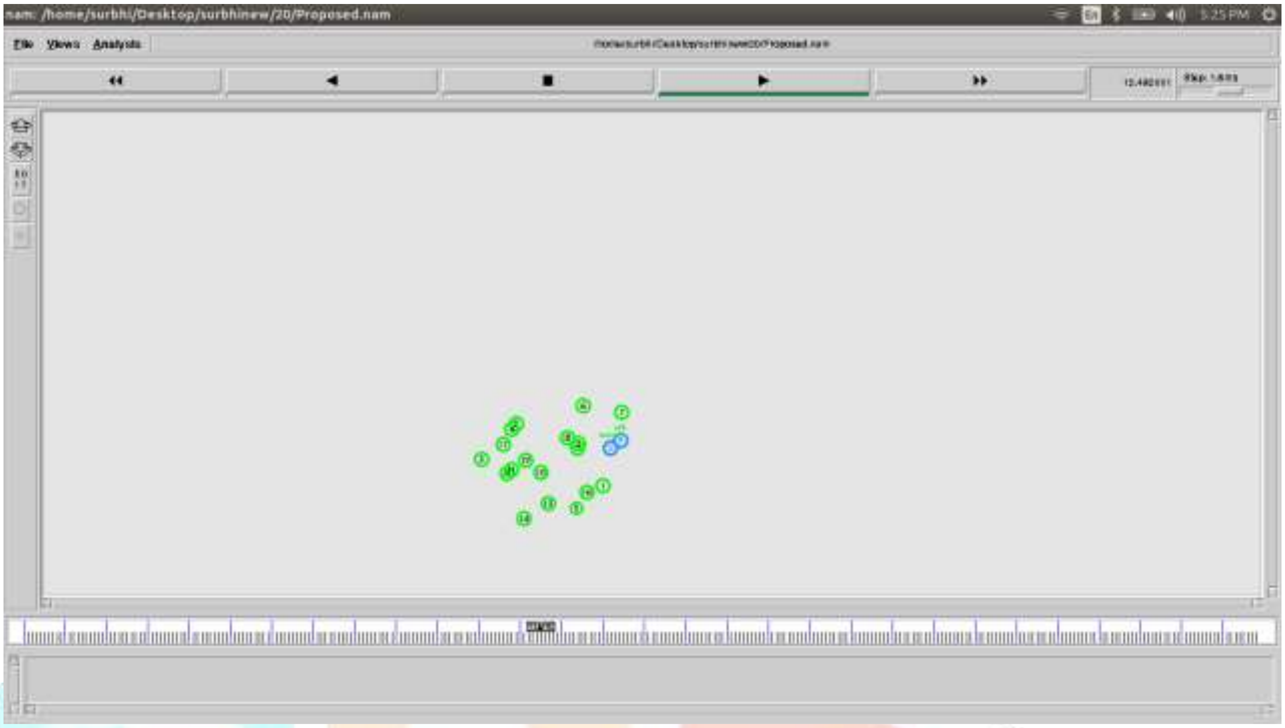

Figure 3.1 Traditional AODV Routing

2. **Simulation of Proposed Buffer Management under Proposed Protocol:** In this phase the network is configured with the help of proposed buffer management technique and their performance is projected for comparative performance study. The required network is demonstrated using figure 3.2. If the network is congested of packet transmission therefore this scenario is buffered the packet using drop tail. This simulation screen shows that if there is packet traffic beyond the traffic load then it stores the packet until capacity of node freed. Simulation is processed over 20 nodes.

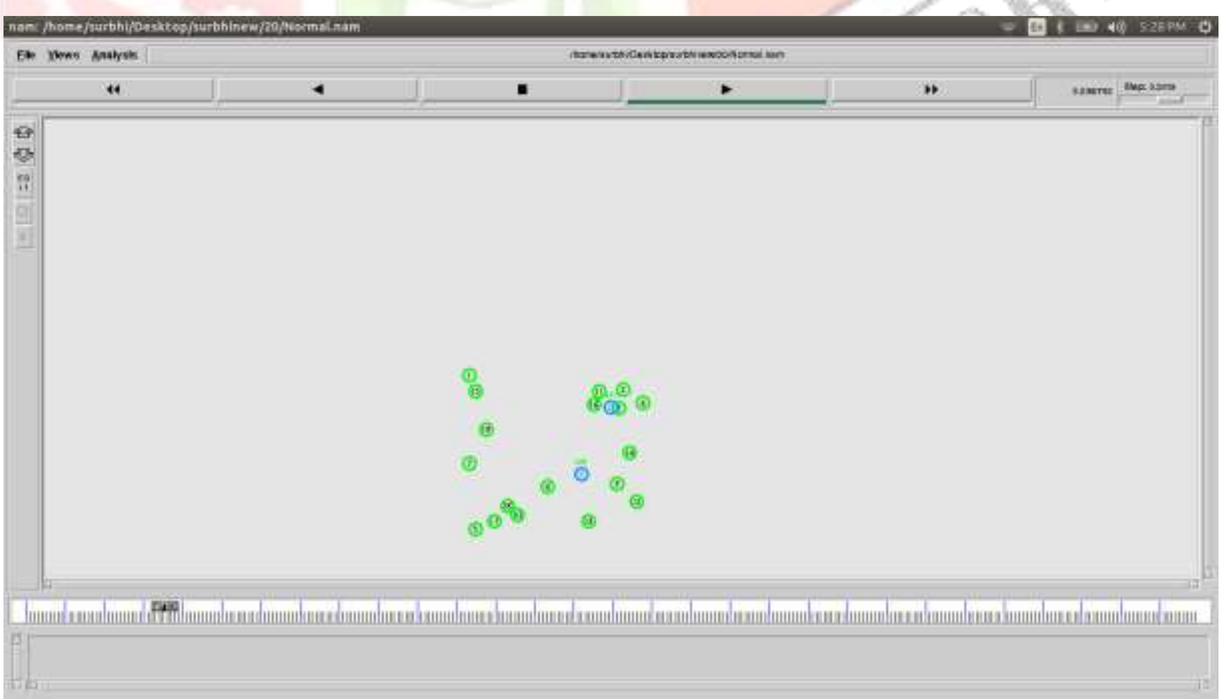

Figure 3.2 Proposed Buffer Management Routing Protocol

IV. RESULTS ANALYSIS

This part gives the point by point exchange about the examinations performed with the directing convention for both typical approach and the proposed Buffer Management steering approach. The similar investigation among both the approach is accounted for in this part.

A. End to End Delay

End to end delay is the time taken by a parcel to fly out from source to goal. Deferral relies upon number of bounces and clog on the system. End-to-end postpone of information parcels incorporates all conceivable deferrals caused by buffering amid course revelation, lining at interface line, retransmission delays at MAC layer, spread and exchange time

$$\text{E2E Delay} = \text{Receiving Time } (R_t) - \text{ Sending Time}(S_t)$$

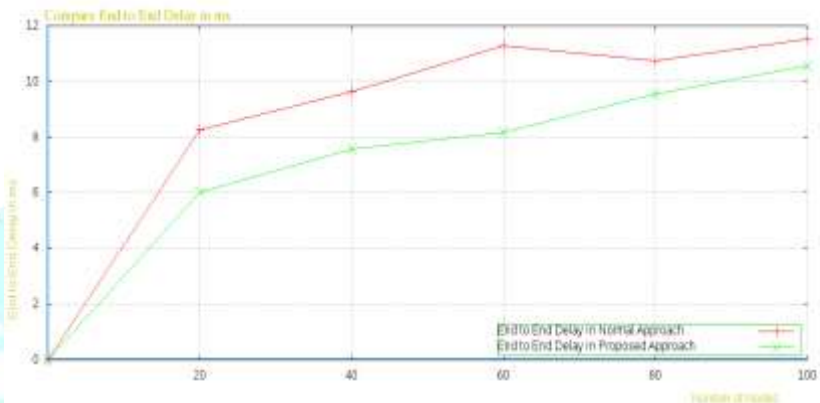

Figure 4.1 End to End Delay Comparisons

The conclusion to end postpones of the proposed approach and existing AODV steering is accounted for in figure 4.1 and table 4.1. In this graph the X hub demonstrates the quantity of system hubs in the examinations and the Y hub demonstrates the measure of end to end postpone as far as milliseconds. The outcomes demonstrate the conclusion to end defer of the system in past approach is higher when contrasted with the proposed convention. In this way the proposed method is much adoptable when contrasted with the conventional AODV. Moreover the expanding measure of system hubs is affect on end to end delay.

Table 4.1: End to End Delay Tabular Form

Number of Nodes	Proposed Buffer Management Routing Approach (In Millisecond)	Normal AODV Routing Approach (In Millisecond)
20	6.02738	8.2738
40	7.5738	9.6335
60	8.1738	11.2738
80	9.5556	10.7576
100	10.5556	11.52

B. Remain Energy

Amid the correspondence and system occasions the hubs devours a piece of vitality from its underlying measure of vitality. Remain vitality of system hubs are recorded and detailed here as the execution parameter of system. The figure 4.2 and table 4.2 demonstrates the measure of vitality devoured in arrange hubs amid the diverse experimentation. The examinations are performed more than 20, 40, 60, 80 and 100 quantities of hubs.

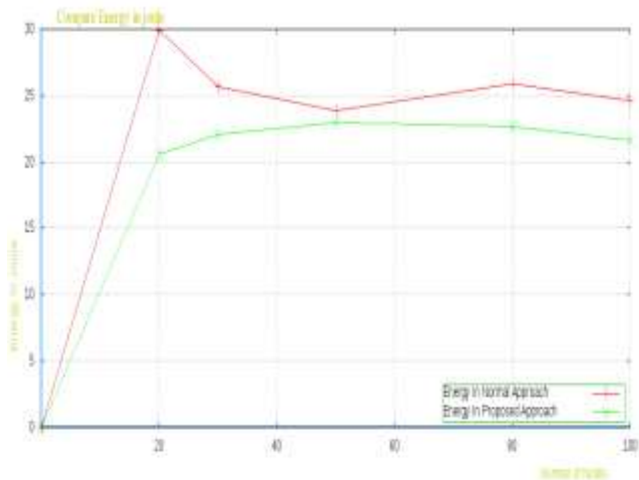

Figure 4.2: Remain Energy

Keeping in mind the end goal to exhibit the execution of systems the X hub contains the quantity of hubs in exploratory system and the Y hub demonstrates the measure of vitality devoured after trials. The estimation of vitality is given here as far as Jules. As indicated by the trial comes about the proposed cradle administration approach expends less measure of vitality when contrasted with the conventional steering approach. Along these lines the proposed approach of cradle administration is vitality productive when contrasted with ordinary system setups with base AODV directing convention for the two reproductions. In this way, AODV of base and proposed convention with cushion administration give expanding normal vitality utilization as system stack builds, bundle activity and clog and subsequently these parcels are send to the goals in this manner, more vitality is expended in effective correspondence of these parcels.

Table 4.2: Consumed Energy Tabular Form

Number of Nodes	Proposed Buffer Management Routing Approach (In Joule)	Normal AODV Routing Approach (In Joule)
20	20.6	29.90
40	22.1	25.63
60	23.0	23.88
80	22.7	25.88
100	21.65	24.58

C. Packet Delivery Ratio

Parcel conveyance proportion is characterized as the proportion of information bundles got by the goals to those produced by the sources. Numerically, it can be characterized as:

$$\text{Packet Delivery Ratio (PDR)} = \frac{S_1}{S_2} \text{ X100}$$

Here, S_1 is the sum of data packets received by the each destination and $S_2$is the entirety of information parcels created by the source hub. Charts demonstrate the part of information bundles that are effectively conveyed amid PDR versus the quantity of hubs. The similar parcel conveyance proportion of customary AODV directing and Buffer administration based procedure is portrayed utilizing figure 4.3 and table 4.3. In this chart the distinctive number of hubs are given in X hub and the Y pivot incorporates the rate measure of parcels effectively conveyed. As per the got comes about the proposed procedure ready to convey more bundles viably when contrasted with the AODV convention. Furthermore that shows 60-70% measure of effectively conveyed bundles in our technique. In this way the proposed system is more powerful when contrasted with the conventional convention. Then again the customary directing demonstrates the 55-65% of effectively conveyed bundles. Consequently the proposed approach is more productive than the customary directing strategy.

Table 4.3: PDR Tabular Form

Number of Nodes	Proposed Buffer Management Routing Approach (In Percentage)	Normal AODV Routing Approach (In Percentage)
20	61.00	57.00
40	65.00	59.00
60	67.00	63.00
80	68.00	62.00
100	70.00	65.00

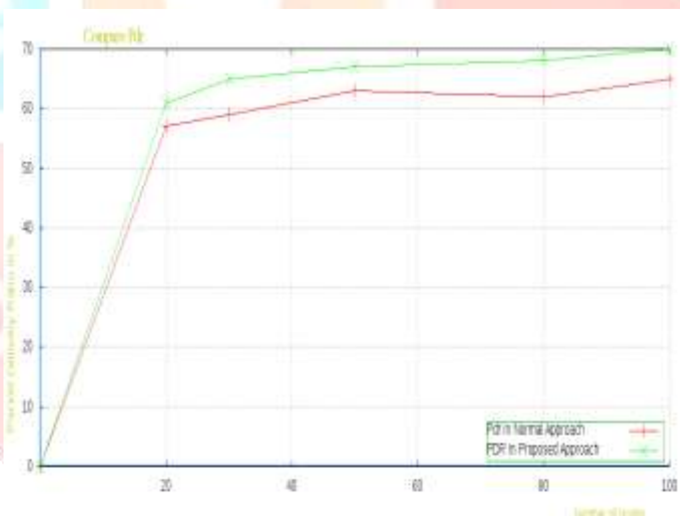

Figure 4.3 Packet Delivery Ratios

D. Routing Overhead

Steering overhead is depicted as the measure of extra bundles infused in organize for correspondence. The key purpose for to process this parameter is, on the grounds that the steering overhead decreases the bundle conveyance proportion and transmission rate of the information. The steering overhead expands the measure of data transfer capacity utilization. The measure of directing overhead for both the system steering situation is given utilizing figure 4.4 and table 4.4. In this graph the measure of hubs in organize is given utilizing X pivot and the Y hub contains the directing overhead of the system. As indicated by the exploratory outcomes the proposed steering convention delivers less overhead when contrasted with the base AODV in this way proposed procedure much reasonable for enhancing other system execution parameters. The principle purpose for less steering overhead is the extra control messages is sent when new course is build up to know taking an interest all hubs.

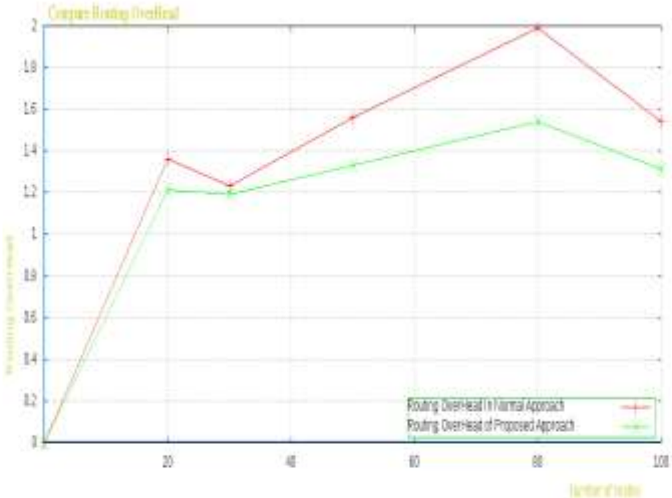

Figure 4.4 Routing Overhead

Table 4.4: Routing Overhead Tabular Form

Number of Nodes	Proposed Buffer Management Routing Approach (In Millisecond)	Normal AODV Routing Approach (In Millisecond)
20	1.21	1.36
40	1.19	1.23
60	1.33	1.56
80	1.54	1.99
100	1.31	1.54

E. Throughput

It is characterized as the aggregate number of bundles conveyed over the aggregate reproduction. This information may be conveyed over a physical or legitimate connection, or go amid a specific system hub. Throughput is the quantity of messages effectively conveyed per unit time. Throughput is controlled by accessible data transfer capacity, and in addition the accessible flag to-clamor proportion and equipment impediments. The throughput is consistently considered in bits every second (piece/s or bps), and infrequently in information bundles every second or information parcels per availability. The relative execution of the customary AODV directing and cushion administration with proposed steering convention is shown utilizing figure 4.5 and table 4.5. In this graph the measure of trial hubs are given in X hub and the Y hub contains the measure of throughput accomplished in the system. The processed throughput of system is accounted for here as far as KBPS (kilobyte every seconds). As indicated by the acquired execution comes about the proposed method empower higher throughput when contrasted with the conventional AODV convention.

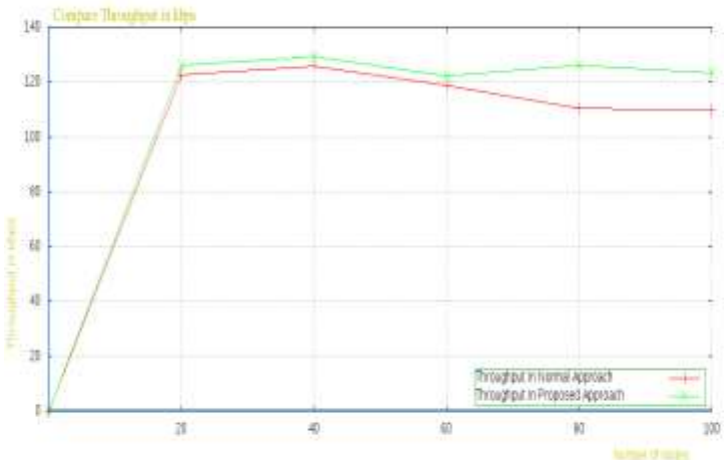

Figure4.5 Throughput

Table 4.5: Throughput Tabular Form

Number of Nodes	Proposed Buffer Management Routing Approach (In KBPS)	Normal AODV Routing Approach (In KBPS)
20	126.01	122.55
40	129.01	125.61
60	122.35	118.68
80	125.87	110.45
100	123.18	109.56

V. CONCLUSION

The proposed work is intended to upgrade the customary steering system for enhancing the proficiency of the system. Along these lines another steering method is proposed and exhibited in this work. The got comes about based outline is portrayed as the finish of the work and the future change on the gave approach is likewise depicted in this part.

A.Conclusion

Mobile ad hoc network is one of the popular network technologies among research and development in networking. The technology is keep attracted due to their different characteristics and possibility of improvement. This network is completely wireless network therefore various kinds of management and service delivery relevant properties are not available in this network. Additionally the mobility add different deficiencies in network such as route break, frequent connection break, availability of route and over loading of route nodes. In this context the proposed work is aimed to study about the overloading of the routes and obtaining the efficient route.

In order to find the efficient route the proposed work introduces a data mining based route selection technique. The proposed work employed the KNN (k-nearest neighbor) algorithm for performing this task. Therefore first a threshold buffer utilization of network nodes is computed by finding mean consumption of buffer during different communication scenarios. In further the threshold value is used to label each node which one is with low buffer length and which one consumed higher buffer length. According to this all the possible discovered routes among source and destination is labeled and then KNN algorithm is implemented for computing the route which has the higher number of one in their route sequence.

The proposed system is executed and exhibited with the quantity of expanding hubs in organize. Furthermore to consolidate the essential usefulness of the idea the AODV steering convention is utilized. The recreation of the proposed working framework is portrayed utilizing NS2 reenactment device. After usage of the proposed system the execution on five parameters are registered and abridged in table 5.1.

S. No.	Parameters	Proposed	Traditional
1	End to End Delay	Low	High
2	Routing Overhead	Low	High
3	Packet delivery ratio	High	Low
4	Throughput	High	Low
5	Energy consumption	Low	High

Table 5.1 Concluding Performance

According to the obtained performance of the proposed AODV routing protocol and the traditional routing technique the proposed model is found efficient comparatively. Therefore the proposed approach is acceptable for the implementing the technique for improving the data rate improvement in mobile ad hoc networks.

B. Future Work

The primary objective of the proposed routing technique improvement in terms of efficiency is accomplished successfully. In near future the following improvements are proposed for work.

1. Considering more parameters (i.e. energy of nodes, packet delivery ratio) for finding more efficient route
2. The work can also be extendable for the issue of path break and route maintenances.

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