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A Real And Accurate Energy Efficient Manetdesign With Link Vector Routing Protocol

Nanditha. Boddu[1] Veeramallu Bobba[2] Ramesh.Vatambeti[3]

[1]Research Scholar, Dept. of CSE, KLEF (Deemed to be University), A.P, India
E-Mail: sridivya1234@gmail.com
[2]Professor, Department of CSE, TKR College of Engineering and Technology, Hyderabad, Telangana, India
[3]Computer Science and Engineering, Presidency University, Bangalore, India.
E-Mail: v2ramesh634@gmail.com

Abstract:

In mobile ad-hoc networks, wireless communication and their links are playing an important key role. The primary function of MANET is offering communication facility between nodes without any involvement of centralized architecture. Therefore in MANET, every node operates not only like a host but also as a router. Mobile ad-hoc networks and their nodes change their behaviour dynamically, a central part of MANET functionality depending on energy efficiency, multiple path access, data routing and intermediate traffic. The energy consumption diminishes network efficiency as well as topological Speed of operations. Because of this network lifetime decreases exponentially. In MANET due to dynamic environment, energy-efficient routing protocols are essential factors. So in this research, a vector routing protocol (VRP) model is proposed to crossover the above limitations and makes the MANET network reliable. VRP is a novel multipath energy-efficient protocol, and it can reduce the packet loss, node failure and providing the alternative network links. The proposed VRP MANET design is implemented on NS2 software and identifying the packet delivery ratio, end to end delay, packet drop, throughput and energy consumption at various time intervals. These metrics are more improved compared to earlier algorithms.

Keywords: *Energy-efficient protocol, MANET VRP and transmission energy.*

1. Introduction

The wireless sensor network comprises mobile ad-hoc nodes, and these remote nodes are operated through without any controlling action. Therefore an advanced node optimization technique is necessary to improve the network lifetime, energy efficiency, throughput, fault tolerance, and multipath routing in MANET. The MANET network is dynamic, so routing, receiving, and sensing information to various nodes continuously. These mobile ad-hoc nodes do not have any supporting power supply, so battery power is necessary. In this mechanism, power consumption plays an essential key factor for network lifetime. The earlier methods like AODV, AOMDV, AODVM, and DSR techniques are [1][2][3] does not solve energy consumption issues in MANET. The mobile nodes in MANET have been controlling through k-mean clustering algorithm[4], which is more costly, and routing density is complex. The particle swarm optimization [5], genetic algorithm[6] based energy consumption mechanisms cannot control the above limitations.

Moreover, service cost, complex operations, and network lifetime issues are significant problems with this technique. Fig 1 clearly explains the MANET network, which is nothing but a self-configured mobile ad-hoc network. In this mobile-devices and nodes connected without wires. It is a spontaneous network connection and collection of dynamic data. MANET is a collaboration of mobile nodes which are host and route the wireless information dynamically with self organize infrastructure. These MANETS cannot be controlled and the inherent lack of operations. The linking, routing, and packet forwarding operations are basic functionalities of ad-hoc networks.

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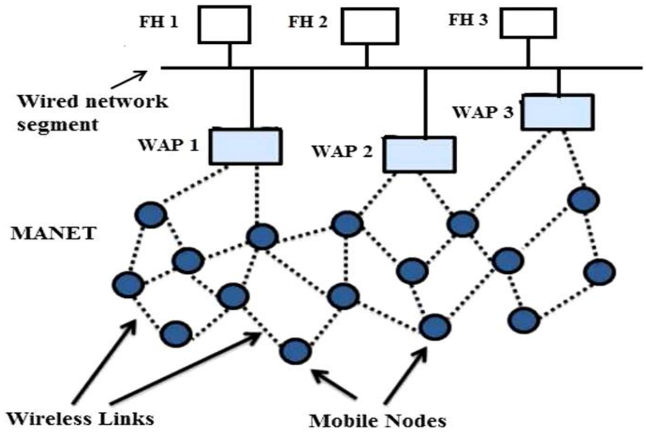

Figure 1: MANET network.

Mobile ad-hoc networks collect more information from the number of wireless nodes that can exchange the packets without any architecture [6]. In MANET, nodes are called routers and hosts, and in this, the connectivity has been varied because of packet delay and fault tolerance between the nodes [7]. MANET has various advantages compared to conventional networks; these are easy to fix and dismantled [8].

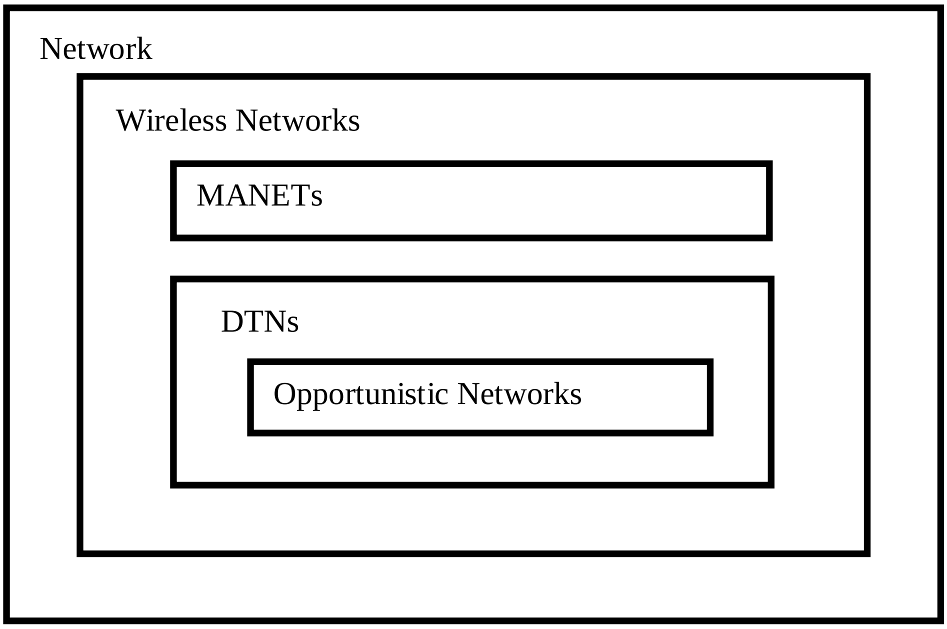

Fig 2 clearly explains an opportunistic MANET network; this channel is consist of wired and wireless modes. Therefore upcoming and present technologies are using the MANET models for the advancement of communication. Here energy-efficiency, lifetime and accurate functionality are necessary. An advanced optimization technique is compulsory to monitor the above elements. Manet communication is offering many 5G applications; in this, clustering usage is more.

2. Related methods

In this section, different clustering algorithms have been demonstrating for verifying the various techniques related to MANET. since recent decades, many clustering optimization models are providing better Routing and reduce energy consumption. These energy-efficient MANET protocols are utilized to increases the lifetime of nodes ultimately. In general, proactive and reactive, two types of routing functionalities are available. In this proactive, they are continuously updating the source node and destination links. Coming to reactive AODV protocol is routing the priority-based

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communication. so that energy is balanced, Compared to the first model, reactive MANET offering more network lifetime.

Reference	Technique	Key point
S.Chinara et.al[9]	Adaptive clustering algorithm	In MANET, clustering algorithms are providing the solution to network challenges. A topology clustering algorithm concentrates on mobility and battery power, so the lifetime of the network, operational Speed, and energy parameters are improved.
SK Das et.al[10]	Intelligent energy-efficient routing.	The challenging task of MANET can be improved by the proposed intelligent energy-efficient optimization. In this dynamic, nodes and capacity of the battery and quick access mechanisms are improved compared through earlier methods.
Hossam et.al[11]	AODV MANET model	The main challenging of MANET is energy efficiency and accurate communication. This parameters are majorly depending on battery power and architecture of the MANET. The node transmission, reception and communication medium continuously consuming the power. So AODV optimization method can control the above the operation and providing the accurate packet delivery ration and reduces the packet loss.
B. Aroraa et. Al[12]	Power aware multipath MANET	AOMDV MANET is a energy efficient mobile ad-hoc network. In this packet delivery ratio, end to end delay and packet loss can be controlled at fixed level. The battery-saving mechanism decides the network lifetime and high traffic loads. In this AOMDV facing above limitations, these can be overcome through proposed MANET model.
P. Rastogi et.al[13]	AODV routing protocol	The ad-hoc on demand link vector can be updating the various links in the network. Therefore AOLV MANET is more useful in wireless sensor

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		network.
S. Sirohi et.al[14]	Weighted cluster algorithm	The weighted clustering algorithm is a MANET model. In this the extra power consumption can be controlled through a message-passing approach. In this, each cluster is re-verified through proposed optimization.
S.P.S Jain[15]	Stable clustering MANET	In this work stable clustering, MANET optimization mechanism is designed for making the network topology stable. In this backup nodes are introduced for getting the information of died and cluster nodes.
A.H.M.E. Koutbi et.al[16]	EEC MANET	In this work EEC MANET mechanism can handle the energy-efficient operations in an accurate manner. The main objective of this work is to optimize the dead nodes and encourage the live nodes.
M.R.Bosunia et.al[17]	RDD MANET	The proposed RDD MANET routing protocol is providing stable, reliable, and energy-efficient operations. The network operations can decide the MANET lifetime with respect to power consumptions. This work facing many limitations like economy and complex design.
M. Saxena et.al[18]	CEE MANET technique	In this work, each clustering node are selected through position and residual operations concerning MANET. The main motto of this work is to optimize the available nodes and giving accurate procedures.
Z.Z.Shirazi et.al[19]	Dynamic k-means MANET network	The K-means optimization mechanism is a effective clustering model, it is reduces the complex Routing such as power consumption, throughput, bandwidth and packet loss. The main objective of this work is to fix the false operations presented in the earlier methods.
M. Saxena et.al[20]	Max-heap tree MANET model	In this work energy efficient network operations are performed through self

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		configure network. It is performed by Max-heap tree model. This model is a multi point relay network, which can train the MANET energy efficient.
M.K.Gulati et.al[21]	Comparison of MANET	In this research work many energy efficient MANET networks are designed through various link matrix models. These models are facing many limitations and are solved by future techniques.
A.Kumar et.al[22]	Energy consumption in MANET	The energy efficient mechanism is proposed through EEM MANET model. It is a advanced energy saving mechanism.

The above table briefly explains earlier MANET models and their limitations. The parameters like network lifetime, packet loss, and packet delivery ratio elements are required to improve, and this can possible only with VRP MANET design.

3. Methodology

The network is made-up of n-number of nodes, where every node denoted like individual terminal; their transmission and related energy consumption can be depending on their properties. The main objective of this work is to improve the network lifetime, reduces the transmission energy, packet delivery ratio, delay, throughput, packet loss, and energy consumption if this function is satisfied then only fault tolerance lessens. The fault tolerance is demanding the following Mal- functionalities such as node failure, network failure, high transmission power, message logging, overload, and link failure. These elements can be cross over through the proposed VRP model.

The nodes connot contacted with opportunistically and don’t have any previous information. This features of MANET result from the longer delays than conventional networks employed by routing or clustering protocol. The existence of elements is shown in Figure 3. The characteristic of the opportunistic network are:

1. Power constrained devices,
2. Intermittent connectivity,
3. Occasional contacts,
4. High mobile node density,
5. The non-existence of end-to-end paths.

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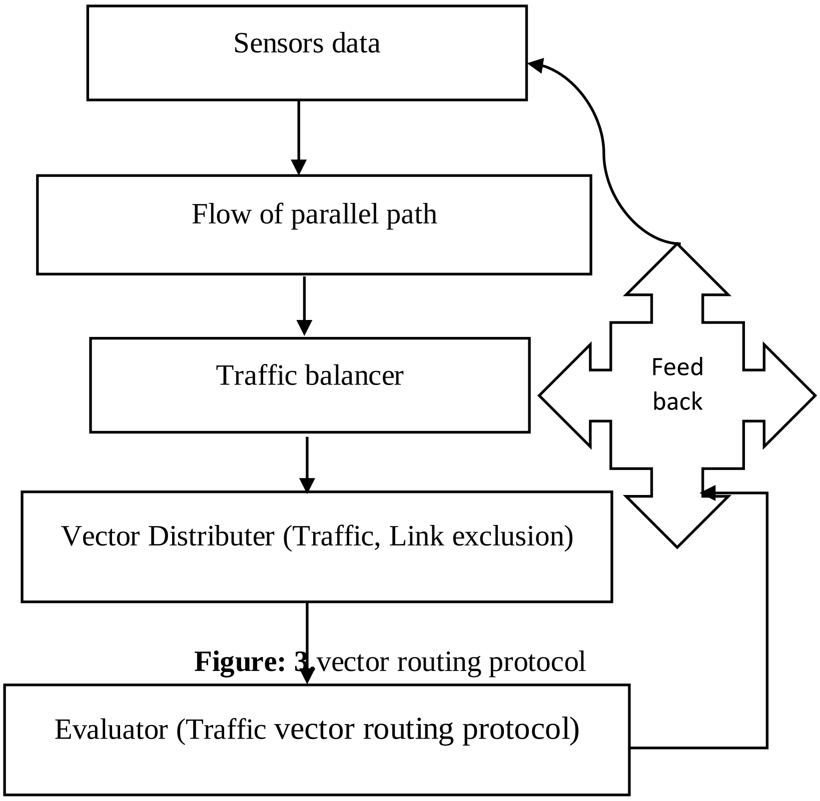

Figure: 3 vector routing protocol

Fig 3 demonstrates the vector routing protocol in MANET design. In this sensor-data is collecting the information from local devices and updating the network continuously, in the second block, parallel path architecture providing multiple communications in the network. The traffic balancer is calculating the overload issues and providing a better link between the nodes. At final VRP protocol working based on two-phase mechanism, in this phase 1 is a clustering model, and step 2 is an improved routing model. T, R, C elements are assuming for energy balancing.

3.1 Mathematical computation of VRP

$$A_{vs} = \frac{\mathrm{Dist}}{t} \tag{1}$$

$$M_0 = A_{vs}(\mathrm{final}) - A_{vs}(\mathrm{initial}) \tag{2}$$

$$T_e = (\text{Transmitted power} * \text{Packet size})/2 \times 10^6 \tag{3}$$

$$R_e = (\text{Receiving power} * \text{Packet size})/2 \times 10^6 \tag{4}$$

$$C_e = T_e + R_e \tag{5}$$

$$R_{es} = I_e - C_e \tag{6}$$

$$P_{av} = \frac{\sum \mathrm{Dist}}{|D|} \tag{7}$$

$$W_t = w_1.M_0 + w_2.P_{av} \tag{8}$$

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A_{VS} is the Average Speed of nodes, M_o is the nodes' mobility, Here equations 1 & 2 calculating the distinct neighbour nodes of mobility and average Speed, i.e. is related to the battery power. Te and Re are the transmission and reception of energy elements. Ce is the energy consumption element; R_{es} is the residual energy element. These are providing the average transmission energy calculations in the MANET. Here P_{av} represents that average transmission power. The nodes, according to the construction technique of max-heap, are clustered into a series of clusters. There is a CH in each collection that executes inter-cluster, interpersonal and inter correspondence communication. Except for the CH significant nodes in a cluster, the ordinary nodes can exist from channel to perform the actual operation, and it can behave as VRP CH. The minimum value of the weight (Wt) correlated with the nodes in a given cluster can be extracted from this collection of VRP CH. The equation representation provides this parameter with weight (Wt):

Algorithm: 1 VRP- clustering

CH creation ()
Start
for i= 0 to n // n is the number of nodes
begin
calculate $W_t[1]$, $W_t[2]$, $W_t[3]$..... $W_t[n]$ // assign the weight of each node, where W_t is the weight
Assign priority $P_r$for each node, such that node with lowest weight is assigned the highest priority
$Pr[1], Pr[2], \dots. Pr[n]$
$End\ for$
$Max - heap\ creation\ (\ )$
$Root\ <--\ Pr[A] //\ highest\ priority\ node$
$Left\ <--\ Pr[L]$
$if\ (Pr[Left]\ > Pr[Root]\ )$
{
$interchange\ Pr[Left]\ <\ -->\ Pr[Root]$
}
$Right\ <--\ Pr[R]$
$if\ (Pr[Right]\ > Pr[Root]\ )$
{
$interchange\ Pr[Right]\ <\ -->\ Pr[Root]$
}
$Cluster\ creation\ (\ )$
$While\ (n)$
{
$if\ (Th\_value\ satisfied)$
$Pr[Right]\ <\ --\ CH$
$Assign\ it\ to\ cluster\ Ci$
$else$
$Max\ heap\ cluster\ (\ )$
end
}

With 'n' number of node, the input network is initialized. For the roots, the weights (Wt) are extracted using (alg:1). This Wt of proper description (Pr) nodes are then connected in such a way that min (Wt) is allocated to max (Pr) in CH development ( ). The whole conserving is then initiated using the construction of the max-heap ( ). This method positions the CH at the tree's root dependent on max (Pr). The Creation () method cluster is called to verify how well a CH adheres to its specified threshold, confirming that the points in the tree are allocated to a Ci cluster. The proposed formula explains this technique of cluster creation detailed notes above.

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Algorithm: vector Routing

Routing( )
Begin
$Initialize\ the\ initial\ energy\ and\ packet\ size$
$For\ i\ =\ 1\ to\ n\ \ //\ n\ is\ the\ number\ of\ nodes\ in\ a\ cluster\ Ci$
$For\ j=\ 1\ to\ n-i$
$\quad Calculate\ Te\ and\ Re$
$Calculate\ Ce$
$Calculate\ theRes$
$If\ (Res[j]\ > Res[j+1])\&\&(Th\_Value\ satisfied)$
$\quad node\ consider\ in\ routing\ path\ and\ packet\ forwarded$
$else$
$\quad discard\ the\ node\ and\ the\ packet\ from\ route\ selection\ process$
$end\ if$
$end\ for$
$end\ for$

After cluster creation, the Process is begun by checking the Ie nodes and setting the bandwidth utilization for data transfer. To continuing this Process, multiple operational values are determined according to (3), (4), (5), and (3), (5) (6). The involvement in the routing path, the Res value obtained by (6) must be greater than a certain level (0.30 per cent of the highest Res), the major VRP node and packets will not be discarded from the route selection process. This selection will be considered for additional passes in clustering. The simulation result will explain clearly in the below section.

Table: 1 various parameter in phase

Number	Case	Analysis
case-1	A new node arrives in the cluster	The VRP is re-balanced according to the weight matrix. Its maximum priority can even replace the existing CH.
case-2	A leaf node departs from the cluster	It does not require VRP paired.
case-3	An in-between node departs from the cluster	Immediate balancing requires to maintain tree structure.
case-4	CH leave from the network	New CH needs to be identify through it has less chance.

In this table: 1 many cases are discussed through analysis statements; here totally 4 topics are discussed for channel description.

Table: 2 simulation requirements

Parameter	**Value**
Area	800 x 800
Simulation Time	300 sec
Traffic Type	CBR
Packet Size	512/1024/2048/4096
Antenna Model	Antenna/Omni Antenna
Initial Energy	160J
Transmitting Power	18W
Receiving Power	9W
Sense Power	3W

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Movement Trace	ON
Threshold matric	0.30%

$$\text{End} - \text{to} - \text{End delay} = \frac{\sum(\text{arrive time} - \text{send time})}{\sum(\text{Number of connections})} \quad \text{------ -(9)}$$

$$\text{PDR} = \frac{\sum \text{Number of Packets Recieved}}{\sum \text{Number of Packets Sent}} \quad \text{------ (10)}$$

Equation 9 and 10 explain about performance measures of designed MANET model.

Experimental results

In this section, various experimental outcomes have discussed with the NS2 simulation window

End-to-End Delay

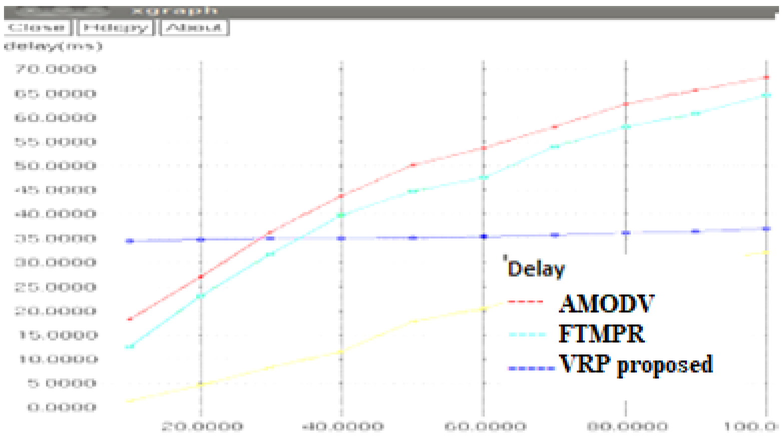

Figure :5 end to end delay ratio

Routing Overhead

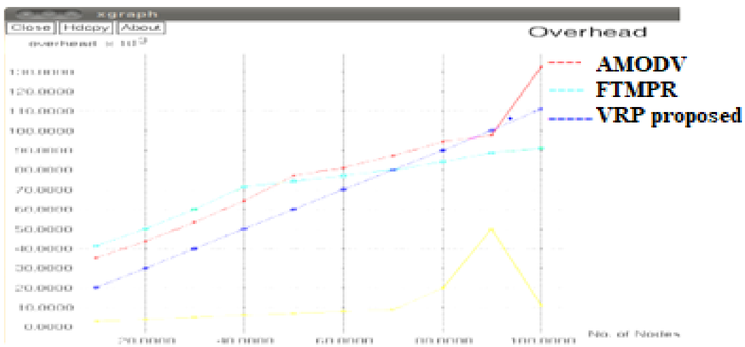

Figure :6 Ruting overhead

Throughput

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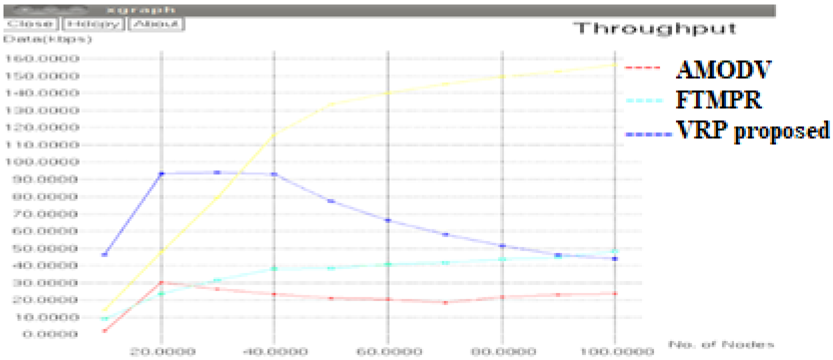

Figure :7 throughput analysis

Energy efficient

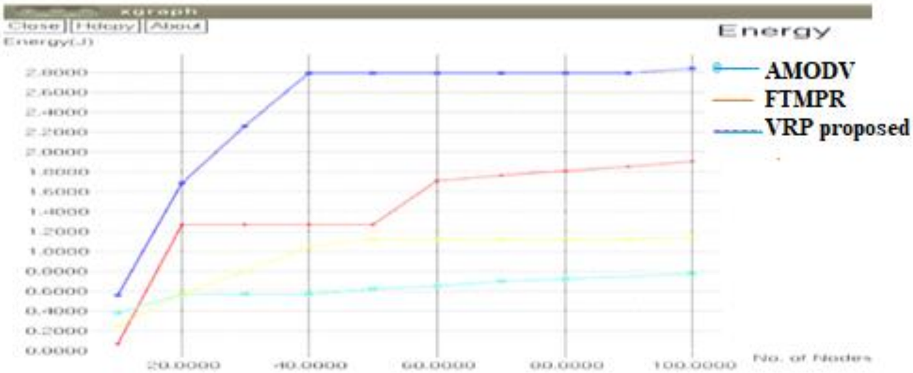

Figure: 8 energy efficacy

Packet Delivery

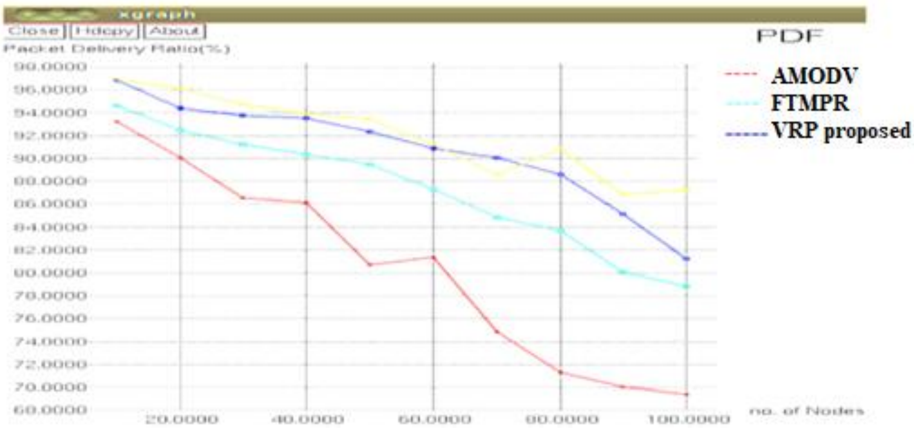

Figure: 9 PDF analyses

Figure 5 to figure 9 are performance measure analysis of proposed method and compared with FTMPR algorithm and TMX optimization method. In this at all circumstances from 2000 nodes to 100000 nodes has been changed as scale on x axis and on y axis packet delivery ratios are portrayed. The FTMPR protocol is used as the basis for distributing multipaths. The suggested scheme causes a

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fallen packet to be saved by more nodes, (i.e.) packet salvaging is spread. From simulation outcomes, it is obvious that with reduced latency, packet drop and resources, the proposed protocol achieves improved throughput and packet distribution ratio.

Table :3 performance measures

S no	Parameter	AOMD	FTMPR	Proposed model
1	Delay(ms)	4.2	2	1.7
2	Throughput (*k)	4.2	4.5	4.7
3	Packet loss(*k)	0.9	0.7	0.49
4	Energy consumption (in J)	5	2.8	1.9
5	Routing overhead(*10^5)	1.3	1.1	0.8
6	Packet delivery ratio	6.9	7.9	8.1

Table 3 explains about various performance methods of delay, throughput, packet loss, energy consumption, routing overhead and packet delivery ratio. Compared to earlier models our proposed model attendance more improvement and giving the better experimental results.

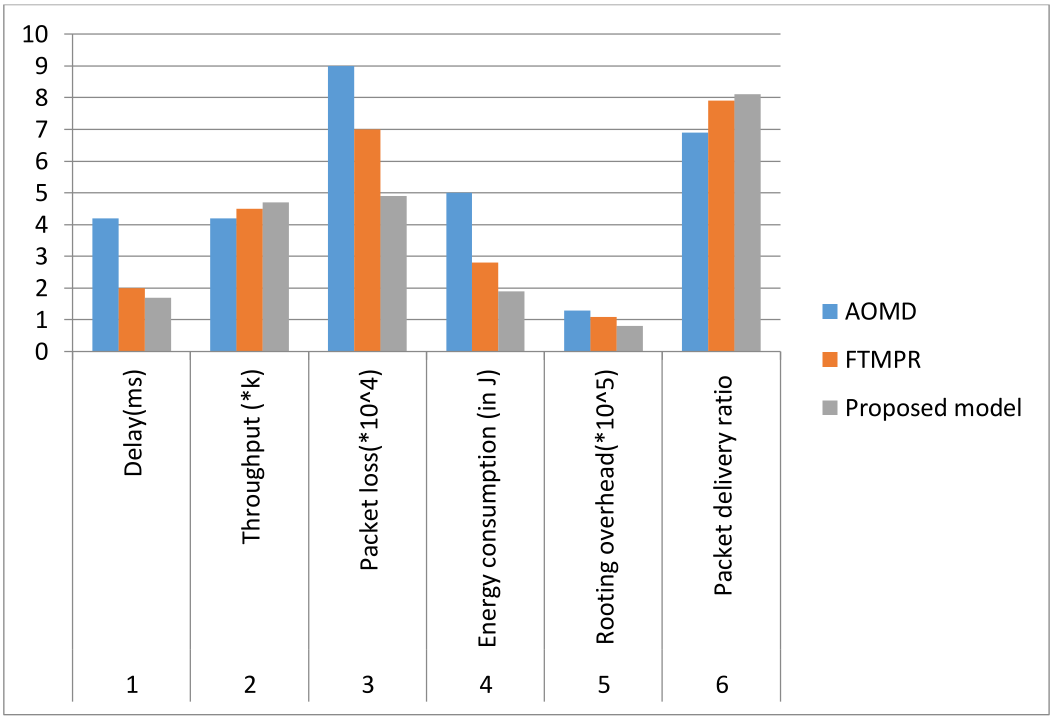

Figure: 10 comparisons of results

Figure:10 clearly explains about the comparison results of AODM, FTMPR and proposed VRP model. At all conditions, the proposed model attains more improvement and outperform the results. Compared to FTMPR, the proposed FTMPR system achieves a 7% higher packet transmission ratio, 49.5% lower average end-to-end delay,7.2% higher throughput, 14.2 per cent lower packet drop, and 42.13 per cent lower energy consumption. The suggested fault-tolerant VRP multipath routing protocol is simulated in this research. A VRP path discovery method had used to reduce the loss of packets due to route slippage. Nodes are efficiently evaluating with several disjoint routes to a vibrant destination. In this procedure, more battery power and energy has been saved.

Conclusion

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In this research work, an advanced MANET technique is proposed with the VRP model. The earlier methods like FTMPR, AOMD, AOMDV, and AODV cannot solve the limitations of MANET. Therefore an advanced mechanism is required for more lifetime of mobile ad hoc networks, therefore VRP model is proposed. This VRP model is implementing for energy efficiency, packet loss, and more lifetime MANET network achievement purpose, it is designed on NS2 software. The delay of the VRP model is 1.7ms, throughput is 4700, packet loss is 4900, energy consumption is 1.9J, routing overhead is 80000, and packet delivery ratio is 81000 have been attained. These results are more improved compared to AOMD and FTMPR.

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