International Journal of Computer Networks and Applications (IJCNA)
DOI: 10.22247/ijcna/2021/209709 Volume 8, Issue 4, July – August (2021)

RESEARCH ARTICLE

Efficient Multipath Zone-Based Routing in MANET Using (TID-ZMGR) Ticked-ID Based Zone Manager

S. Venkatasubramanian
Department Computer Science and Engineering, Saranathan College of Engineering, Trichy, Tamil Nadu, India
drvenketcsephd@gmail.com

A. Suhasini
Department Computer Science and Engineering, Annamalai University, Tamil Nadu, India
suha_babu@yahoo.com

C. Vennila
Department of Electronics and Communications Engineering, Saranathan College of Engineering, Trichy, Tamil Nadu, India
vennila-ece@saranathan.ac.in

Received: 16 July 2021 / Revised: 06 August 2021 / Accepted: 15 August 2021 / Published: 28 August 2021

Abstract – Mobile ad hoc networks (MANETs) is an infrastructure-less network, which is self-organizing, self-configuring and dynamic. The traditional routing protocol is not efficient against the routing challenges. The traditional MANET routing mechanisms involve overhearing, retransmission, and idle listening, which consume high energy. The main obstacles for MANET are end-to-end delay, energy consumption, and packet collision problems. The enhancement of network lifetime and communication performance is still a challenging task. This paper proposes a Ticket-ID zone manager routing protocol (TID-ZMGR) with sleep scheduling for MANETS. The proposed system consists of a zone routing system that is effective in load balancing and energy-efficient. In the proposed approach, nodes in the network are grouped as zones with a zone leader (ZL). The ZL is the node with higher efficiency in terms of energy, link quality, connectivity, and distances. The TID-ZMGR follows a multipath mechanism for balancing the load, and traffic is controlled by distributing the path from source to destination. The implementation of an adaptive sleep duty cycling approach ensures error-free communication around the network. Additionally, the adaptive sleep duty cycling approach increases the overall accuracy by saving the power on border nodes. The efficiency of the proposed work is proved by the comparison work carried out between Ticket-ID Based Routing management system (TID-BRM) Zone-based Routing with Parallel Collision Guided Broadcasting Protocol (ZCG) and Distance aware Zone Routing Protocol (DZRP) with TID-ZMGR. Experimental work evaluation metrics are zonal leader changes, energy consumptions, and network lifetime. Simulation result shows proposed mechanism achieves minimum energy consumption with improved output on throughput and packet delivery ratio.

Index Terms – MANET, ZL, ZCG, DZRP, TID-ZMGR.

1. INTRODUCTION

MANETs incorporates communication with the number of nodes or mobile devices within the range through the wireless links. In the network, routing is done between the two hosts with one or more nodes [1,2]. The network connectivity is dynamic and linked between the mobile nodes. MANET does not have any infrastructure which free to join and move anywhere at any time. MANETs are widely used in government premises, military, emergency management, commercial premises, private sectors, and much more. The most common issue in MANET is frequent network topology changes because of constant node mobility. In the routing table, frequent route changes in the network are updated, and through the valuable network resources, control packets rush into the network. As a result, identifying and maintaining a good route in the network becomes complex [3,4].

Several methodologies evolved in allowing mobile nodes to evaluate the neighbor's density and trade-off low broadcast redundancy with reachability. It enables maximum network reachability, throughput, and low broadcast latency. The existing routing protocols have minimum broadcasting latency; an enhanced protocol design phase addresses these issues effectively. During transmission, power management very challenges, and packets are transmitted without considering the position of the nodes inside the zone. The receiver nodes received powers is inversely proportional to the square of the distance between them. The sender and receiver node distance is very less; hence power is wasted. The next issue is the utilization of bandwidth. The distance

RESEARCH ARTICLE

between the sender and the border nodes is increased, then the zone area will also increase. It shows the lack of sufficient radio coverage between the sender nodes and border nodes in the zone. The number of broadcasts from the sender node increases on reaching the border node in the zone, which results in bandwidth maximization.

Generally, mobile wireless networks like wireless IP networks and cellular contain centralized base stations and wired backbones. But MANET does not have any base station or wired connectivity. A node in the wireless connectivity will perform both as a router and host, from source to destination, the routes in the network change frequently because of node mobility. In the past years, identifying the best optimal route with minimum overhead is a challenging and complex task for researchers. The main reason for this difficulty is designing a reliable routing protocol with the available bandwidth and power is a big challenge for the researchers. If a reliable routing is designed, the network becomes stable, and the energy consumption is reduced by utilizing the limited resources efficiently according to the various network conditions.

The zone routing protocol (ZRP): In MANET, routing algorithms are three classes such as proactive, reactive, and hybrid. The reactive routing algorithm requires more route setup delays. The proactive routing algorithm needs to reserve the routing information. The hybrid routing protocol contains both the characteristics of proactive and reactive to overcome the issues created by the proactive and reactive algorithms. The zone routing protocol (ZRP) is the best-known hybrid routing protocol.

The proactive protocol needs additional bandwidth requirements, and the ZRP overcomes this issue by minimizing the zonal area. This method enables easy maintaining of routing information. ZRP enables storing nodes routing information proactively in the local area and for nodes present afar through reactive routing. During this efficient route, requests are achieved without requesting all the nodes in the network [5-9].

The objective of this research is;

- Proposing a multipath mechanism for balancing the load and traffic
- Ensuring error-free communication by implementing an adaptive sleep duty cycling approach
- Enhancing network lifetime and communication performance
- Implementing a controlled centralized distribution the path from source to destination

This paper is organized as follows: Section 1 describes the introduction, section 2 describes the related works, section 3 describes the proposed methodology, section 4 describes the result & discussion, and, finally, section 5 describes the conclusion.

2. RELATED WORK

W.-H. Liao et al. (2001) [10] proposed a grid-based routing mechanism, a location-aware reactive routing protocol. The GRID is term replacing zone with gateway node; in this mechanism, routing is done via gateway node using grid-by-grid. There are several nodes in the network, and a predefined gateway election mechanism is used to select the gateway node from the other nodes. GRID is similar to reactive routing protocols; the same route request and route reply mechanism is used to identify the route paths for sending packets from source to destination.

Smaller grid size and gateway election at a smaller distance from the center of the grid is the major issue in the GRID mechanism. Because of the smaller grid size, the selected gateway nodes often move out of the grid range, so new getaways need to be selected. This multi-changing of gateway node makes the network unstable. The range is the only metric consider for selecting the gateway node; apart from this, no metrics like speed, moving direction, etc., are considered. Here routing is based on a grid-by-grid manner, and grids are within the node's radio range. For a wider range, additional hops are required, which makes the protocol unworthy.

Ray and Turuk et al. (2016) [11] developed location-based topology control(LBTC) for ad hoc networks. It is an energy conservation mechanism developed using the sleep scheduling concept. LBTC characteristics are the combination of the topology control approach and power management approach. Similar to the topology control approach, it minimizes the node's transmission power. LBTC identifies the traffic according to situation enables nodes to sleep state similar to the power management approach. LBTC does not partition the neighborhood; it analyzes the traffic and makes the node to sleep state.

Basurra et al. (2014) [12] proposed a zone-based routing protocol with a parallel collision-guided broadcasting protocol (ZCG). ZCG implements parallel and distributed broadcasting methods for quick selection of a path for minimizing redundant broadcasting. By doing this, the node's energy consumption is minimized, and the reachability ratio is maximized. ZCG applies a one-hop clustering algorithm, according to which the network is divided into zones with dependable leaders.

Sudarsan (2014) [13] developed distance aware zone routing protocol (DZRP) for addressing the basic problem raised using ZRP. The cause of issues defining the zone radius, node's actual distance is not considering. DZRP proves as an effective solution for handling the ZRP issues. DZRP

RESEARCH ARTICLE

execution is simple and effective, which can also be modified according to the network situation.

Bhattacharya et al. (2013) [14] and Shakya and Markam (2016) [15] proposed ZRP based generic algorithm for handling the delay problems caused in the tolerant network (DTN). According to the expected minimum delay is estimated and known as MEED. According to which the packet transmission allows only with minimum delay. The proposed work is tested in the simulated environment, which results effectively than the traditional methods.

Ullah et al. (2019) [16] developed a traffic priority-based delay-aware and energy-efficient path allocation routing protocol for wireless networks (Tripe-EEC). According to which residual energy is used for selecting the optimal paths. The nodes' high residual energy is identified during the minimum rise in temperature. Priority-based path allocation consists of various classifications, which are based on the eliminating struggles and improved equation.

M. B. Talawar et al. (2020) [17] discussed the frequent link breakages in MANET with high node mobility. The major drawback is that if the node loses the neighbor communication, it loses the interaction with other nodes. The nodes that get disconnected depend on the new path exploration session, resulting in additional overhead with delay in packets' delivery time and broadcasting issues.

S. Mirjalili et al. (2019) [18] proposed a Genetic algorithm, an adaptive stochastic optimization algorithm. This approach utilizes natural evolution perceptions for searching and optimization. GA is used for evaluating optimal or close optimal solutions for the search problems.

D. Kukreja et al. (2019) [19] proposed a GA-based secure and energy-aware routing (GASER) protocol for sparse MANETs. GASER protocol chooses the best routing path for packet transmission between the source and the destination. The combined approach of GA results with shortest path selection. This selected route contains the maximum probability of message routing and a high energy level for forwarding the messages.

D. G. Zhang et al. (2018) [20] proposed a GA-bacterial optimization algorithm for achieving optimum routing selection. Here GA is initiated for checking various routes to the destination node. The bacteria optimization of bacteria foraging (BFO) algorithm easily finds the initial locations of optimal routes and explores the best direction.

S.Venkatasubramanian et al (2021)[21] In this paper the authors have clearly explained about the Ticket-ID Based Routing management system for efficient routing for whole network. We achieving the better performance metrics are packet deliver ratio, end-end delay, routing overhead using in this mechanism TID-BRM. In this research work extend the next level work the Ticket-ID based zone manager protocol.

3. PROPOSED METHODOLOGY

The major components in the proposed TID-ZMGR architecture are the network model, TID-ZMGR manager, route planning, and ticketing pool. The TID-ZMGR manager is the important core of the proposed model. Initially, the network model is deployed with multiple nodes to form a network within a range. The entire network communication is under the supervision of the ticket routing manager. During the network model initialization, all the network node fir registered with a ticket ID from the ticket pool. The TID-ZMGR manager does this ticket ID initialization. The main reason for allocating a unique ticket ID for the nodes is to track the node's every behavior and saves it for further process. Next node classification process means nodes in the network are classified into active nodes and inactive or resting nodes. From the active nodes, TID-ZMGR allocates the zonal supervisor (ZS) node, zonal gateway node (ZG), and zonal leader node (ZL). The main responsibility of the ZS is to monitor and manage the nodes list for forming the zone network. ZG took the responsibility of performing interazone routing. TID-ZMGR coordinates all the zone components and calculates the communication performances.

3.1. Zone Creation

In our work, the simulation environment setup is done with 100 nodes. The simulation area is about 1800*1800 and split into 4 regions, as shown in table 1. The main advantage of zone creation is it minimizes the energy consumption and enhances maximum throughput and packet delivery ratio, with increased lifetime. This communication approach identifies faults tolerant easily and perfectly monitors the node's behaviors in zone-wise. The major components on zone creation are zone supervisor (ZS), zone leader (ZL), and the zone gateway (ZG) control by Ticket ID-based Zone manager TID-ZMGR

3.2. Zone Leader (ZL)

The zone leader (ZL) is the entire controller of the zone and updates the zone information to the ZS. ZL selection is based on the node with maximum communication time with high energy and low distance. The proposed diagram in figure 1 and its explanation describe more about the ZL.

3.3. Zone Supervisor (ZS)

Zone supervisor (ZS) is the monitoring node with high bandwidth selected by TID-ZMGR. The entire control zone is under the supervision of ZS, as ZS only allocates ZL. ZS selects the upcoming ZL and shares the information with TID-ZMGR. The proposed diagram in figure 1 and its explanation describe more about the ZL.

International Journal of Computer Networks and Applications (IJCNA)
DOI: 10.22247/ijcna/2021/209709 Volume 8, Issue 4, July – August (2021)

RESEARCH ARTICLE

3.4. Zone Gateway (ZG)

Zone gateway (ZG) is also selected by the TID-ZMGR, which collects packet information with inter-zone and intra zone. That is the transmission of packets from one zone to another. The TID-ZMGR manages the ZG workflow.

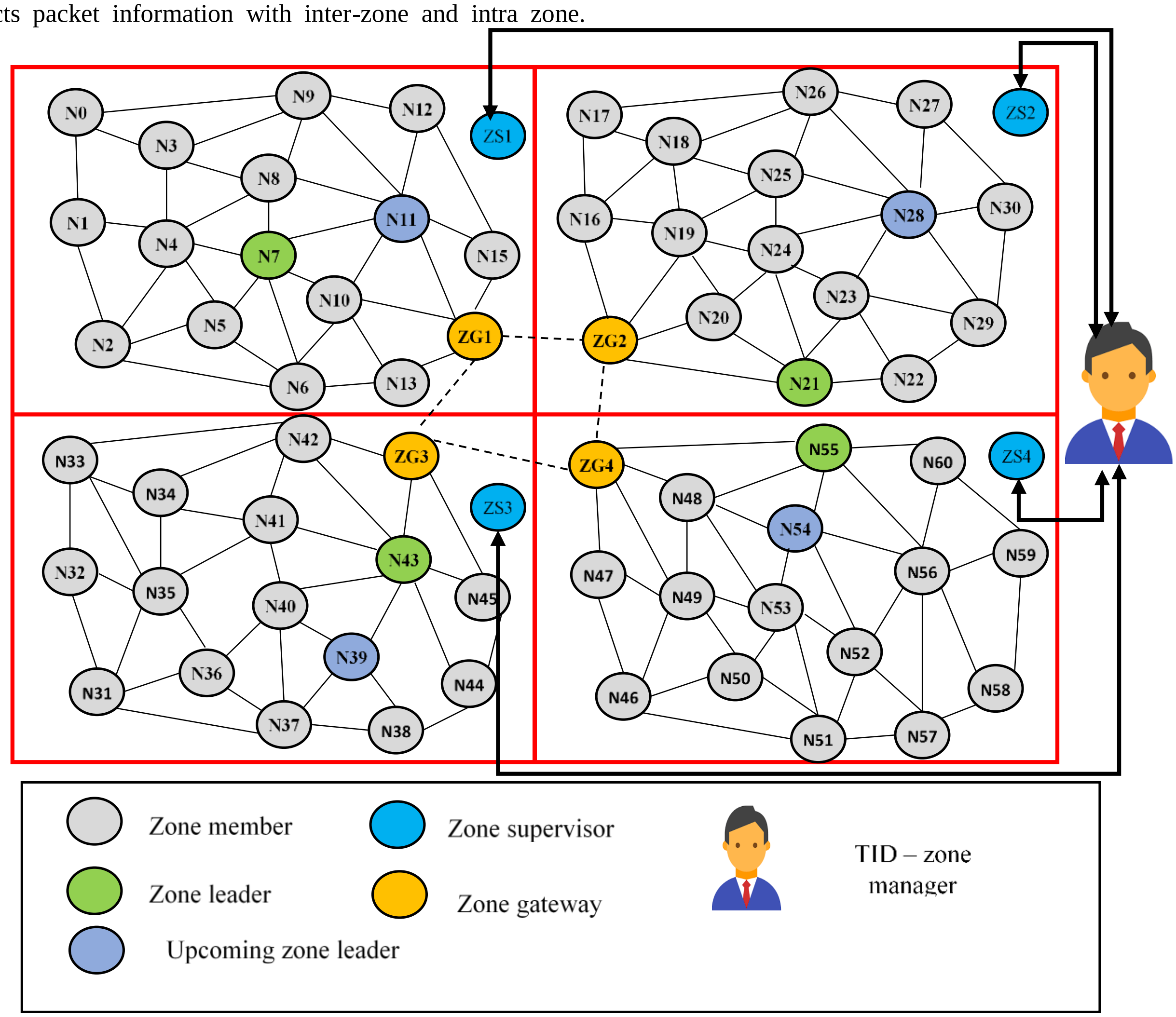

Figure 1 Proposed Architecture

The figure 1 shows the implementation of the network model in a random fashion between the range of 1800 * 1800, respectively. There are 60 nodes deployed in the network model in which the first zone is with the nodes N0 – N15, the second zone with the nodes N30 – N45, and the third zone is with the nodes N45 – N60. TID-ZMGR is the primary component of the proposed mechanism, which is responsible for monitoring, managing, and controlling the entire network transmission. The first progress done by the TID-ZMGR is initializing ZS such as ZS1, ZS2, ZS3, ZS4, respectively. Which node have the highest energy and low distance that node that nodes act as ZL according to TID-ZMGR already updated routing table is done, In Z1 N0-N12 the ZL N7 is decided by ZS according to with TID-ZMGR. The N7 is a current ZL; after particular, the packet transmission process starts when energy will automatically reduce in N7. The TID-ZMGR decides which node has the next ZL decide by the routing table and execute by ZS. In Z1 upcoming ZL 11,15,13,4. Other zones will do the same process.

1. Step-1 node deployment and (MT-ID -ZMGR)
2. initialization Nodes randomly deployed $[\mathrm{M_n}]$;
3. Initialize the TIDZMGR $[\mathrm{TID} - \mathrm{Z_{mgr}}]$;
4. $[\mathrm{TID} - \mathrm{Z_{mgr}}] \rightarrow [\mathrm{M_n}]$ issue the ticket – id to all mobile nodes;
5. $[\mathrm{M_n}] \rightarrow$ send "hello" messages to neighboring node;

RESEARCH ARTICLE

6. $[M_n \to \text{Active}] \to$ Reply from neighboring node received the Ack node state" active" ;
7. $[M_n \to \text{idle}] \to$ neighboring nodes not reply , node state "idle" ;
8. $[TID - Z_{mgr}] \leftarrow M_n$ update the $TID - Z_{mgr}$; // mobile node response updated ;
9. Nodes parameters update to the $[TID - Z_{mgr}]$;
10. $[M_{NE}] \to ZL_{prob} = ZL_{prob} * \frac{E_{RS}}{E_{max}}$ // $ZL_{prob} \to$ intial zone leader probality ;
11. $[M_{ND}] \to \sqrt{(P_i - P_j)^2 + (Q_i - Q_j)^2 + (V_i)^2}$; // $(P_i - Q_i)$ position of coordinates of i_{th} announcing node; $(P_j - Q_j)$ are the center coordinates of the grid, and V_i is the velocity of the *i* th node.;
12. $[M_{Np}] \to (x_1 - y_1), (x_2 - y_2), (x_3 - y_3) \dots (x_n, y_n)$; // node position coordinates of f (x, y)
13. $[M_{NBW}] \to \left(\frac{N_{pkt}(tx) * S_{pkt}}{T_t}\right)$ // The total consumed bandwidth calculated by the packet transmitted with packet size and total time taken. Where $N_{pkt}(tx) \to$ the number of packets transmitted; $S_{pkt} \to$ size of packet; $T_t \to$ total time taken to transmit;
14. $M_{NNS} \to (1800 * 1800)$ deployed in network area accordingto NS2;
15. $[TID - Z_{mgr}] \to [M_{NE}], [M_{ND}], [M_{ND}], [M_{NBW}], M_{NNS}$ // all node parameters updated to $[TID - Z_{mgr}]$;
16. zone splitting according with step − 14 $Z1, Z2, Z3, Z4$
17. Zone leader(ZL), zone supervisor node(ZS) , Zone gateway (ZG) elections based on $[TID - Z_{mgr}]$
18. Allocate high bandwidth $[TID - Z_{mgr} \to ZS\ (1gb)]$ // monitor node only
19. Allocate high bandwidth $[TID - Z_{mgr} \to ZG\ (1gb)]$ // packet transfer node
20. $[TID - Z_{mgr}] \to (M_{ND} \geq M_{NE})$ // high energy and low distance that mobile node act as ZL;
21. $[TID - Z_{mgr}] \to (M_{ND} \leq M_{NE})$ // low energy and high distance that mobile node act as ZM;
22. $[TID - Z_{mgr}] \to (M_{ND} = M_{NE})$ // equal distance and energy that node upcoming ZL;
23. $[TID - Z_{mgr}] \to ZS\ [M_{NE}], [M_{NP}], [M_{NBW}]$. // which node have high energy and bandwidth that node act as primary gateway nodes ZS and update to the $[TID - Z_{mgr}]$.
24. $[TID - Z_{mgr}] \to ZS\ [M_{NE}], [M_{ND}], [M_{ND}], [M_{NBW}]$. // which node have high energy and bandwidth that node act as secondary ZS and update to the $[TID - Z_{mgr}]$.
25. all network process update by $[TID - Z_{mgr}]$

Algorithm1 (TID-ZMGR) Ticket ID-Based Zone Manager Routing Protocol

TID-ZMGR collects the information from ZS and updates the status regularly. Based on the information provided by the zone supervisors (ZS1, ZS2, ZS3, ZS4), TID-ZMGR decides which are nodes are eligible to take part in transmission. TID-ZMGR declares how many nodes are taking part in transmission. These declarations are decisions taken from the most recent information provided by the ZS. Next is the selection process of zone leader (ZL) and the ZL selection process is determined in the algorithm 1.

Zone ID	Neighboring nodes	Current ZL	Upcoming ZL	zone supervisor
Z1	0-15	7	11,15,13,4	ZS1
Z2	16-30	21	28,25,23,16	ZS2
Z3	31-45	43	39,41,34,36	ZS3
Z4	46-60	55	54,49,56,52	ZS4

Table 1 Routing Table Based on TID-ZMGR

Table 1 shows the implementation of the proposed mechanism, which contains four zones with their zone ID as Z1, Z2, Z3 & Z4, respectively. Each zone is allocated with zone supervisors such as ZS1, ZS2, ZS3 & ZS4. The first zone is Z1 with the zone supervisor as ZS1, and the nodes are N0 – N15 with N7 as a zone leader. The upcoming zone leader for zone 1 is N11, N1, N13 & N4. The second zone is Z2 with the zone supervisor as ZS2 and the nodes in the zone

RESEARCH ARTICLE

are N15 – N30 with N21 as a zone leader. The upcoming zone leader for zone 2 is N28, N25, N23 & N16. The third zone is Z3 with the zone supervisor as ZS3 and the nodes in the zone are N31 – N45 with N43 as a zone leader. The upcoming zone leader for zone 3 is N39, N41, N34 & N36. The fourth zone is Z4 with the zone supervisor as ZS4 and the nodes in the zone are N46 – N60 with N55 as a zone leader. The upcoming zone leader for zone 4 is N54, N49, N56 & N52.

4. EXPERIMENTAL RESULTS

4.1. Simulation Environment and Parameters

Network Simulator-2 is used for executing the proposed TID-ZMGRBR. In the simulation environment, the network model is deployed with 100 nodes within the range of 1800 × 1800 m2. The proposed network model is designed using the Random way mobility model. According to which the nodes in the network are independent to anywhere. The link-layer protocol used in the proposed model is the IEEE standard of 802.11 Mac protocol. The multicast constant bit ratio is used for generating the traffics in the network, and WLAN heterogeneous traffic is considered for both 802.11b and IEEE 802.11e protocols. Data connection is established via TCP or UDP network topology, and the node mobility range is between 10-35/ms. The size of the packet used for transmission is 2000 bytes with 24 Mbps of data rate. Below table 2 describes the other parameters involved in the proposed experimental work.

Simulation Parameter	Value
Simulator	Network Simulator-2
Simulation time	200 seconds
Number of nodes	100
Simulation area	1800 × 1800 m^2
Mac Protocol	IEEE 802.11
Data rate	24 Mbps
Radio range	100 meter
Mobility model	accidental waypoint model
Antenna	Omnidirectional antenna
Node speed	10-35 m/s
Packet size	512 bytes
Traffic type	Multicast constant bit ratio

Table 2 NS2 Simulation Parameter

Notations	Description
$\mathrm{TID} - \mathrm{Z_{mgr}}$	Ticket-id zone manger routing
$\mathrm{M_n}$	Mobile nodes
$\mathrm{M_{NE}}$	Mobile node residual energy
$\mathrm{M_{IND}}$	Mobile node distance
$\mathrm{M_{NP}}$	Mobile node position
$\mathrm{M_{NNS}}$	Mobile node network size
$\mathrm{ZL_{prob}}$	initial zone leader probability
$\mathrm{M_{NBW}}$	Mobile node bandwidth
$\mathrm{N_{pkt}(tx)}$	the number of packets transmitted
$\mathrm{S_{pot}}$	size of packet
$\mathrm{T_t}$	total time taken to transmit
ZL	Zone leader
ZS	zone supervisor
ZG	Zone gateway
ZM	Zone member

Table 2 Notation and Description

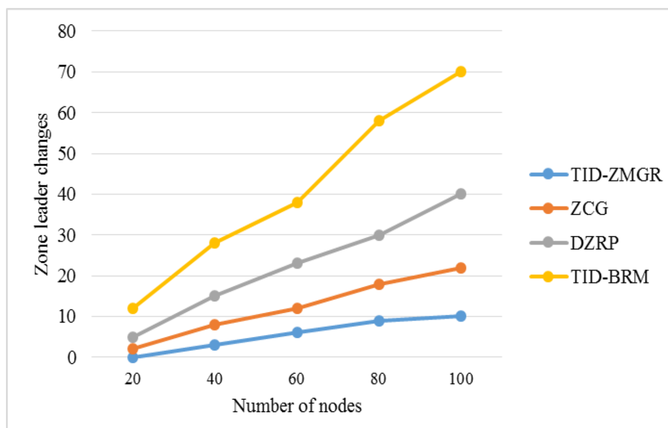

Figure 2 Zone Leader Changes vs Number of Nodes

Figure 2 illustrates the comparison work carried out between the proposed TID-ZMGR with TID-BRM, ZCG, and DZRP. The performance metrics taken for this comparison is zonal leader change with the number of nodes. The minimum zonal leader changes declare the routing stability of the network. From figure 2, the x-axis determines the number of nodes taken for the experiment. At each stage node, volume is

International Journal of Computer Networks and Applications (IJCNA)
DOI: 10.22247/ijcna/2021/209709 Volume 8, Issue 4, July – August (2021)

RESEARCH ARTICLE

gradually increased in the count of 20. The y-axis determines the zonal leader changes with the respective number of nodes. At each stage, the observation is obtained by the three algorithms notes and plotted in the graph for analysis. The proposed TID-ZMGR achieves 2 zone leader change at 20 nodes, with 40 nodes 8 leader changes, with 60 nodes 12 leader changes, with 80 nodes 18 leader changes, and with 100 nodes 22 leader changes. This result proves that the proposed TID-ZMGR is far better than the ZCG and DZRP in the observation of zonal leader changes.

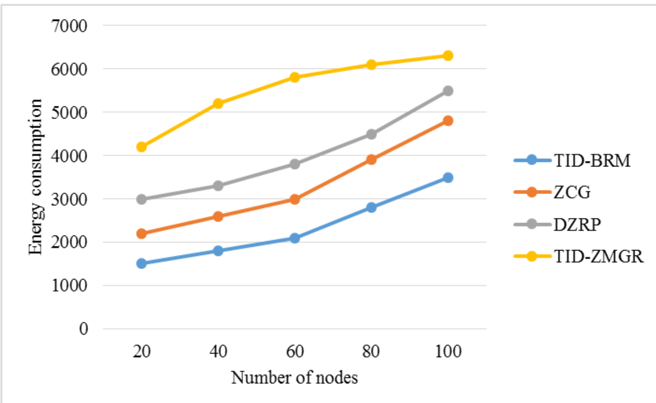

Figure 3 Energy Consumption vs Number of Nodes

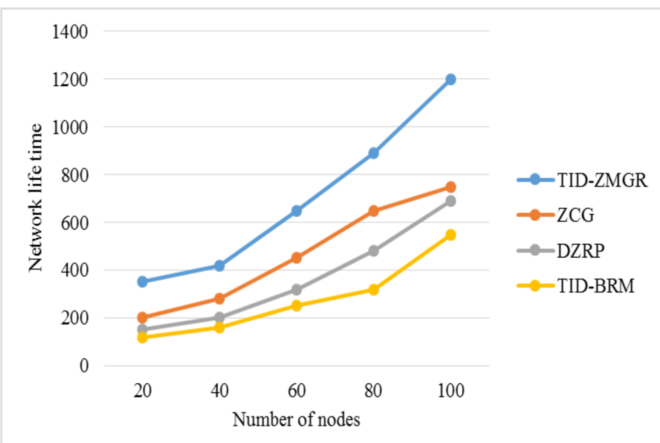

Figure 4 Network Lifetime vs Number of Nodes

Figure 3 illustrates the comparison work carried out between the proposed TID-ZMGR with TID-BRM, ZCG, and DZRP. The performance metrics taken for this comparison are energy consumption with the number of nodes. The minimum energy consumption declares the efficiency of the overall network performance. Based on which minimum energy is consumed means maximum efficiency is achieved. From figure 3, the x-axis determines the number of nodes taken for the experiment. At each stage node, volume is gradually increased in the count of 20. The y-axis determines the energy consumed by each algorithm with the respective number of nodes. At each stage, the observation is obtained by the four algorithms notes and plotted in the graph for analysis. From which the proposed TID-ZMGR achieves 1500 J for 20 nodes, 1800 J for 40 nodes, 2000 J for 60 nodes, 2800 J for 80 nodes, and 3500 J for 100 nodes. Here J determines joules; the energy consumed is calculated in the term of joules. The above-plotted graph shows the minimum energy consumption by the proposed TID-ZMGR than the TID-BRM, ZCG, and DZRP.

Figure 4 illustrates the comparison work carried out between the proposed TID-ZMGR with TID-BRM, ZCG, and DZRP. The performance metrics taken for this comparison are network lifetime with the number of nodes. The network lifetime is nothing but shows the active transmission, which means a higher network lifetime results in a higher successful transmission ratio. From figure 4, the x-axis determines the number of nodes taken for the experiment. At each stage node, volume is gradually increased in the count of 20. The y-axis determines the network lifetime achieved by each algorithm with the respective number of nodes. At each stage, the observation is obtained by the four algorithms notes and plotted in the graph for analysis. The network lifetime is calculated in terms of sec. The proposed TID-ZMGR achieves 380 secs for 20 nodes, 400 secs for 40 nodes, 650 secs for 60 nodes, 900 secs for 80 nodes, and 1200 secs for 100 nodes. The above-plotted graph shows the proposed TID-ZMGR achieves a high network lifetime than the TID-BRM, ZCG, and DZRP.

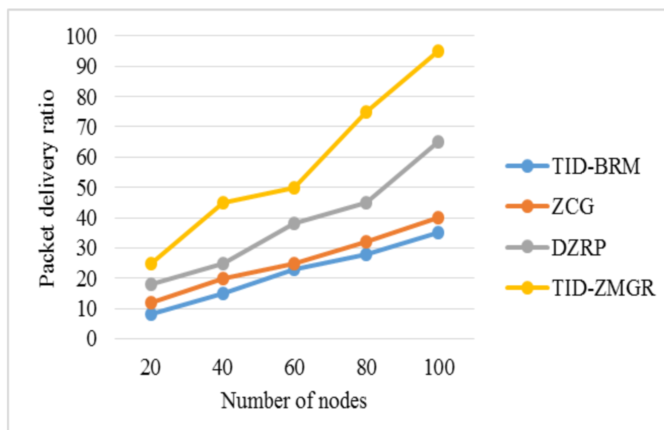

Figure 5 Number of Nodes Vs Packet Delivery Ratio

Figure 5 illustrates the comparison between the proposed TID-ZMGR with TID-BRM, ZCG, and DZRP. The performance metrics taken for this comparison is the packet delivery ratio with the number of nodes. The packet delivery ratio determines the total number of successful packet transmissions. The x-axis determines the number of nodes taken for the experiment. At each stage node, volume is gradually increased in the count of 20. The y-axis determines the packet delivery ratio achieved by each algorithm with the

RESEARCH ARTICLE

respective number of nodes. At each stage, the observation is obtained by the four algorithms notes and plotted in the graph for analysis. The proposed TID-ZMGR achieves 25 packets ratio for 20 nodes, 45 packets ratio for 40 nodes, 50 packets ratio for 60 nodes, 75 packets ratio for 80 nodes, and 95 packets ratio for 100 nodes. The above-plotted graph shows the proposed TID-ZMGR achieves a high packet delivery ratio than the TID-BRM, ZCG, and DZRP.

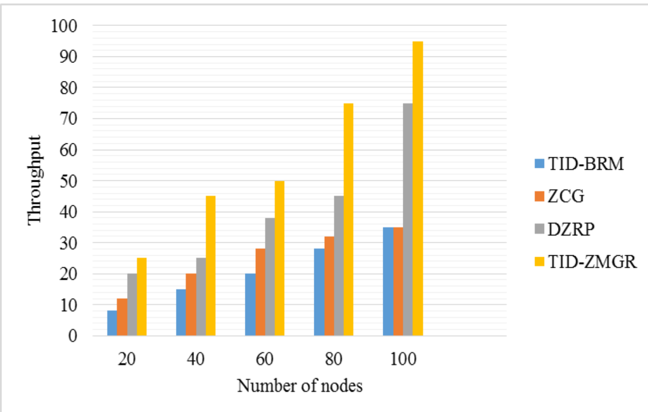

Figure 6 Number of Nodes Vs. Throughput

Figure 6 illustrates the comparison work carried out between the proposed TID-ZMGR with TID-BRM, ZCG, and DZRP. The performance metrics taken for this comparison is throughput with the number of nodes. The x-axis determines the number of nodes taken for the experiment. At each stage node, volume is gradually increased in the count of 20. The y-axis determines the total throughput achieved by each algorithm with the respective number of nodes. At each stage, the observation is obtained by the four algorithms notes and plotted in the graph for analysis. From which the proposed TID-ZMGR achieves 25 % for 20 nodes, 45 % for 40 nodes, 50 % for 60 nodes, % 80 nodes, and 95 % for 100 nodes. The above-plotted graph shows the proposed TID-ZMGR achieves a high packet delivery ratio than the TID-BRM, ZCG, and DZRP.

5. CONCLUSION

In this paper, the Ticket-ID zone manager routing protocol (TID-ZMGR) is proposed to improve MANET routing performance. The traditional MANET routing mechanisms suffer from high energy consumption due to overhearing, retransmission, and idle listening. The proposed TID-ZMGR addresses this issue by enabling zone area and getting each node updated information frequently. Based on the path effective path is selected and achieves minimum energy consumption. The centralized zone manager monitors, manage, and controls the entire network. This network transmission under the zone manager manages the load balance and controls the traffic. As a result, network lifetime is increased, and network efficiency is also increased. To prove the performance of the proposed system, a comparison work is carried between the proposed TID-ZMGR with ZCG and DZRP. The performance metrics taken for the comparison are zone leader changes, energy consumptions, and network lifetime. On all the aspects, the proposed TID-ZMGR is very effective than the ZCG and DZRP. The obtained experimental result shows proposed TID-ZMGR efficiency on the overall network is far better than the traditional routing protocols.

REFERENCE

[1] Ravilla D, Putta CSR (2012) Energy Management in zone routing protocol (ZRP). In: Wyld D, Zizka J, Nagamalai D (eds) Advances in computer science, engineering & applications. Advances in intelligent systems and computing, vol 167. Springer, Berlin, Heidelberg, pp 355–366

[2] Sateesh Kumar P, Ramachandram S (2009) Load balancing in genetic zone routing protocol for MANETs. World Acad Sci Eng Technol 35:517–522

[3] Nair AL, Perumal Sankar S (2016) Sleep scheduling technique for geographic routing in MANET. Int J Adv Res Electric Electron Instrum Eng 5(2):674–680

[4] Beijar N (2008) Zone routing protocol (ZRP). Networking Laboratory, Helsinki University of Technology, Espoo

[5] Aastha Mishra,Shweta Singh,Arun Kumar Tripathi, (2019). Comparison of MANET routing protocols, A Monthly Journal of Computer Science and Information Technology (IJCSMC), Vol. 8, Issue. 2, ISSN 2320–088X, pg.67 – 74

[6] K.Spurthi, T.N.shankar, An Efficient Cluster Computing Mechanism for Wormhole Attack Detection in MANET, International Journal of Advanced Science and Technology 29(7)(2020)

[7] Hossain, S., Hussain, M. S., Ema, R. R., Dutta, S., Sarkar, S., & Islam, T. (2019). Detecting Blackhole attack by selecting appropriate routes for authentic message passing using SHA-3 and Diffie-Hellman algorithm in AODV and AOMDV routing protocols in MANET. (2019),10th International Conference on Computing, Communication, and Networking Technologies(ICCCNT)

[8] K.Spurthi, T.N.Shankar, A Research on Wormhole Attack in Mobile Adhoc Networks, International Journal Of Recent Technology and Engineering,8(14) (2019) 1125-1130.

[9] Khan, M. F., Aadil, F., Maqsood, M., Bukhari, S. H. R., Hussain, M., & Nam, Y. (2019). Moth fame clustering algorithm for internet of vehicle (MFCA-IoV)

[10] W.-H. Liao, J.-P. Sheu, and Y.-C. Tseng, “GRID: a fully location-aware routing protocol for mobile ad hoc networks,” Telecommunication Systems, vol. 18, no. 1–3, pp. 37–60, 2001.

[11] Ray NK, Turuk AK (2016) A hybrid energy-efficient protocol for mobile ad hoc networks. J Comput Netw Commun 2016:1–11

[12] Shadi Basurra, Marina De Vos and Julian A. Padget , "Energy Efficient Zone-based Routing Protocol for MANETs", https://www.researchgate.net/, 2014, DOI:10.1016/j.adhoc.2014.09.010

[13] Sudarsan D (2014) Modified distance aware zone routing protocol for less delay transmission in MANET. Int J Res Eng Adv Technol 2(5):1–6

[14] Bhattacharya I, Bhattacharyya D, Barman S (2013) ZMEED: a zone based enhanced hybrid routing protocol for delay tolerant network. Int J Comput Appl 2013(2):7–11

[15] Shakya M, Markam K (2016) Comparison of AODV and DSR routing protocols by using group mobility model with varying pause time in vehicular ad-hoc network. International Journal of Hybrid Information Technology Vol.9, No.2 (2016), pp. 177-182 http://dx.doi.org/10.14257/ijhit.2016.9.2.15

RESEARCH ARTICLE

[16] Ullah F, Ullah Z, Ahmad S, Islam IUI, Rehman SU, Iqbal J (2019) Traffic priority-based delay-aware and energy-efficient path allocation routing protocol for wireless body area network. J Ambient Intell Humaniz Comput 10:3775–3794

[17] M. B. Talawar and D. Ashoka, "Link failure detection in MANET: A survey," in Modern Approaches in Machine Learning and Cognitive Science: A Walkthrough Studies in Computational Intelligence, vol. 885. Cham: Springer, pp. 169–182, 2020.

[18] S. Mirjalili, "Genetic algorithm," in Evolutionary Algorithms and Neural Networks. Studies in Computational Intelligence, vol. 780. Cham: Springer, pp. 43–55, 2019.

[19] D. Kukreja, D. K. Sharma, S. K. Dhurandher and B. R. Reddy, "GASER: Genetic algorithm-based secure and energy-aware routing protocol for sparse mobile ad hoc networks," International Journal of Advanced Intelligence Paradigms, vol. 13, no. 1–2, pp. 230–259, 2019.

[20] D. G. Zhang, S. Liu, X. H. Liu, T. Zhang and Y. Y. Cui, "Novel dynamic source routing protocol (DSR) based on genetic algorithm-bacterial foraging optimization (GA-BFO)," International Journal of Communication Systems, vol. 31, no. 18, pp. e3824, 2018

[21] Venkatasubramanian, S., Suhasini, A. & Vennila, C. An Efficient Route Optimization Using Ticket-ID Based Routing Management System (T-ID BRM). Wireless Pers Commun (2021). https://doi.org/10.1007/s11277-021-08731-6.

Authors

S. Venkatasubramanian received the B.E. degree in Electronics and Communication from Bharathidasan University and M.E. degree in Computer science from Bharathidasan University. He has 20 years of teaching experience. He is currently pursuing doctoral research in mobile Ad hoc networks. His areas of interest include mobile networks, Network Security and software Engineering. He has published seven papers in the international journals. At present he is working as Associate Professor in Department of CSE at Saranathan college of Engineering, Trichy, India.

Dr. A. Suhasini, is an Associate professor in the Department of CSE Annamalai University. She has around 25 years of teaching experience. She has guided several research scholars and published more than 20 papers in the international journals and conferences. Her area of interest include Computer Networks, Image Processing, Machine learning techniques, Pattern classification Techniques, Network security.

Dr. C. Vennila is a Professor in the department of ECE at Saranathan college of Engineering. She has around 25 years of teaching experience. She is guiding several research scholars and published several papers in the international journals and conferences. Her area of interest include Computer Networks, VLSI and reconfigurable computing.

How to cite this article:

S. Venkatasubramanian, A. Suhasini, C. Vennila, "Efficient Multipath Zone-Based Routing in MANET Using (TID-ZMGR) Ticked-ID Based Zone Manager", International Journal of Computer Networks and Applications (IJCNA), 8(4), PP: 435-443, 2021, DOI: 10.22247/ijcna/2021/209709.