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RESEARCH ARTICLE

ZBLE: Zone Based Leader Election Energy Constrained AOMDV Routing Protocol

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Abstract – In today's life, Wireless Networks (WNs) are being used very fast in every area. They have been used in various applications, but finding some of the weaknesses, such as mobility, diversity, lack of resources and so on, finding an optimum route is very complex and problematic. By reducing the energy consumption on each node, the quality of the network can be ensured. Need to increase the battery life of the node to increase the network lifecycle. Therefore, reducing energy consumption can extend the battery life of the node. There is a fundamental research issue for finding and maintaining routes between multi-path routing nodes. This paper discusses routing protocols based on Zone Technology, which uses the energy, distance, and power of the node to maintain high circulation and accelerate the path search process and maintain high search. Zone-based Leader Election Routing Protocol (ZBLE) is one of the new protocols, which is a modified form of AOMDV. The Zone Leader Node and Zone Members are selected using the value of energy, position, and power of the node. The performance of the proposed communication protocol is evaluated with other existing protocols such as AODV and AOMDV. The simulation result is that when it receives the best path for data communication with proper energy conservation. Network simulator version 2.35 is used for simulation purpose. To support our ideas, we used the 5 quality of service parameters such as packet distribution ratio, energy consumption, network lifetime, and throughput.

Index Terms – Zone Based function, Energy Efficient Protocol, Mobile Ad-hoc network, Multipath Routing.

1. INTRODUCTION

The routing protocol in wireless technology is classified into three parts: reactive, active and hybrid. Roots are set on request. Nodes have no prior knowledge of the destination nodes in the reactive path.

In Active routing, paths in the network are evaluated for each node and these nodes are constantly checked. In hybrid routing, uses zones and cluster-based routing. The main purpose of this route is the exploitation of powers and reducing the vulnerabilities of an active approach.

The use of communication technologies between wireless devices and these devices has advanced in recent years. In addition, in the future, it is also expected that the use of mobile wireless computing will be faster. Most future developments are likely to have such a topology, which is multi-hop, dynamic, random, and sometimes varies rapidly.

Ad Hoc Networks are made of mobile nodes that communicate on wireless links without central control. Such networks are important in the development of wireless networks. Due to multi-hop nature, lack of fixed infrastructure, and self-route, and many problems such as bandwidth optimization, enhanced transmission quality, and power control, have been taken directly from the ad hoc network [1].

The Internet Engineering Task Force has made several proposals on various methods and protocols to prevent these issues. And even many standardization efforts are being made in academic and industrial undertakings [2]. In MANETs, mobile nodes have an impact on the network due to the limited battery. Due to the limited battery, network connectivity and its lifetime decreases. A routing protocol based on energy and power [3] is needed to extend the life of strong network connectivity. There is a protocol to increase the network life, which selects such nodes to carry forward the data in which their batteries have high energy levels. And such protocol nodes reduce energy consumption. Using such protocols in MANET [4], different route cost and path

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selection algorithms have been examined, which aims at improving energy efficiency. During the past years, many multi-path routing protocols have been developed, designed to increase the life span of a path and increase network performance. [5]

The multipath protocol enables the source node to choose the best route from multiple routes by reducing the number of search processes during a single path searching process. If a route fails for some reason, then another good route can be chosen with the help of the backup route. Using multipath technology, network life will be increased by Controlling the End to End Delay and energy consumption. [6].

In the Multipath Routing Protocol, problems with a large number of mobile nodes become more complicated. Due to the limited power source of mobile nodes, more energy is lost on data transfer, so consumption of energy should be controlled to increase the life of the network [7].

This paper provides zone-based energy-efficient multipath routing protocols called Zone-based Leader Election Energy Constrained AOMDV Routing Protocol (ZLL). This protocol selects multiple zones on the basis of energy level and power for data forwarding, using the Zone Creation and Leader Node Election Algorithms, thus selecting the best route can be selected.

The simulation results of the ZBLE protocol have been compared against other standard routing protocols like AODV and AOMDV. Both protocols are the most popular protocols in mobile ad hoc networks. These protocols have been standardized by the Internet Engineering Task Force (IETF). These protocols have been thoroughly tested for real-world applications. Due to these reasons, they have been chosen to compare.

In this paper, we offer a modern routing approach that can consider zone-based techniques for energy conservation and best path analysis. The main challenge of this protocol is not only to consider energy but to design a multipoint routing approach by meeting the routing process in an efficient manner.

In order to fulfill this challenge, this letter has been arranged in the form of the following. Section I and II have presented a literature review and ZBLE protocol in detail. The proposed protocol ZBLE and its functionality have been described in Section III. The proposed algorithm for ZBLE is introduced in Section V. Simulation environment and simulation results are presented in section VI. Finally, the research has been abolished on section VII.

2. RELATED WORK

Energy saving in wireless networks is one of the critical problems. Most routing protocols in MANET have attempted to reduce energy consumption. Some related previous works have been mentioned in this section.

A crowd control adaptive multipath route protocol has been proposed by the Sound Rajon S, [8] to avoid congestion and load balancing in MANET. The algorithm for this routing protocol computes fail-secure multi-paths. This provides many routes to select for intermediate nodes to reach the destination. In these paths, the nodes have at least load, more battery, and residual energy. This results in less visitor load on a crowd link. Whenever the weight of a node reaches a limit, it distributes visitors on the dispersed multi-path path.

Amjad Ali, [9] suggested that the opportunity route will be used towards the destination. In this approach, each node avoids the crowd in a greedy fashion. This helps in keeping away the congested node in the route. Current status of interface queue length is found. The maximum queue length is 60. The congestion threshold is of queue size 50. When the crowd has reached the border, the node ignores the new RREQ packet and does not allow any new route through it.

For load-balancing and power-savings, Tuan Anh Le, [10] suggested EcMTCP. When the crowd has reached the border, the node ignores the new RREQ packet and does not allow any new route through it. This research work focuses on energy base load balancing mechanism to achieve congestion control. As an additional point, it is also modified multipath routing technology for the reduction of end-to-end delay.

This is a crowd-free path search approach to balance the load. The length of the queue is used by Shalinipuri, [11] the crowd has been detected in the network. To decide for free and balanced congestion, the queue length and collective values of hop count have been used. As soon as the length of the queue reaches a limit then the load is balanced by changing the path. This protocol gives better results of packet delivery ratio, throughput, reduced packet delay, and packet drop.

To find an optimum path, Akheel Taha [12] suggested FF-AOMDV, which reduces energy consumption in multi-routing. The FF-AOMDV protocol works on the basis of the fitness function. Before sending data packets between source and destination in this function, energy level and hop calculation is kept in mind. There were also some deficiencies in earlier development protocols like AOMR-LM or AOMDV. In AOMR-LM, the delay and power consumption was achieved from the lower end to reduce consumption, but the worst performance in the packet delay ratio was performed. Atomic energy is required in AODDV but the reduction of throughput and delay to end-to-end is reduced. Addressed the problem discussed in the Protocol discussed with the help of the FF-AOMDV protocol; however, these protocols could not solve the problem of network life.

Smile et al[13] to protect the residual energy of nodes an energy-efficient multipath route protocol called AOMR-LM

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has been proposed and network life can be increased by balancing the energy consumed by this protocol. Residual energy of nodes, energy thresholds and coefficient parameters are used to calculate energy levels, ensure energy conservation and classify nodes. This energy level is used to categorize multiple path selection mechanisms. This protocol is compared to AOMDV and Zone-Disorder Ad-Hawk on-demand multi-path distance vector (JD-AOMDV). With the help of this protocol, the lifetime of the network has been extended. Protocol performance is evaluated in the context of network-lifetime, energy consumption, and end-to-end delay.

To reduce congestion, Maheshwari, Jee, [14] have tried to reduce congestion by managing the congestion load. The sender's rate is managed using the receipt (ACK). Packet loss is reduced by using packets' previous capabilities. The basic AOMDV was efficiently unable to balance the community load. The simulation result shows that the packet distribution ratio is a better one and the average delay is less than the other protocol.

Manickavelu and Vaidyanathan [15] demonstrate the effect of the route search process by energy consumption, data loss, and communication overhead. They proposed a PSO based lifetime forecasting algorithm for routine retrieval in MANET. Based on the criteria such as the relative dynamics of nodes and energy exhaust rates, these protocols predict the lifetime of the link and node in available bandwidth. A weak node has been converted into a strong node using the path retrieval system. Simulation results indicate that the proposed technology reduces communication overhead and packet loss.

Jain, Jai Kumar, [16] has considered the ad-hoc on-demand distance vector routing protocol and the Optimized Link State Routing Protocol and has created a new hybrid protocol. The main properties of both protocols are combined to create new hybrid routing protocols. The simulation result carried out on different parameters shows that the proposed protocol displays better results than AODV, OLSR and ZRP.

3. PORPOSED MODELLING

3.1. Zone Based LEADER Election Energy Constrained AOMDV Routing Protocol (ZBLE)

Proposed protocol is based on zone-based technology and relies on network decomposition in embedded areas although many multipath routing protocols are designed for ad hoc networks, the importance of implementing this protocol is that we are implementing the energy, power, and position of the node to choose the best energy route to send data packets. Figure 1 explains the function of ZBLE with a block diagram.

The scenario is built under MANET, so it represents the MANIT network. Here the Random Mobility model has been taken, which allows the nodes to move randomly. Between the source and the destination, we get many paths from multipath technology. But in these ways, we have to choose some optimize path. The zone-based model is coming under multipath routing. There are three categories to work with this zone-based model, how to implement a zone-based model with the help of multiple paths, energy labels, position tracking, power analysis.

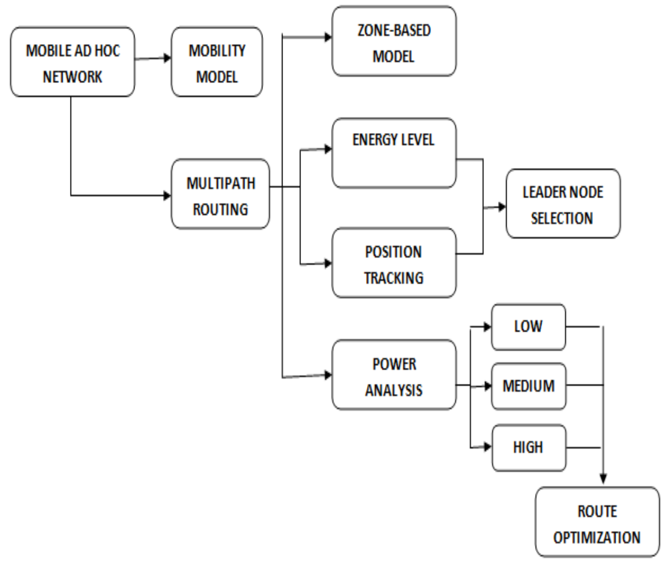

Figure 1 Block Diagram of the ZBLE

We will get a selection of the best path through which we will be able to achieve zone based technology. In this process, we will select the path based on the zone created by its members and leader node. Zone Leader Node and Members node are selected by keeping in mind two factors. Energy labeling and positioning tracking mean distance.

Leader node can be selected only after the assumption of energy label and position tracing. After selecting the Leader node, the power analysis is classified into three labels, low, medium, and high.

Based on these three labels, it has been decided that which node should be appropriate to carry out the data? Here, the route has been adapted to the zone-based technique with the help of many routing, energy label, position tracking, and power analysis.

3.2. Methodology

Multipath routing is difficult in MANETs due to the constantly changing network topology and link capability. There are some properties in the nodes of MANETs which are as follows: The nodes are not stable and they dynamically change their place. Every node has the same capability in the duration of data processing, computational power, and data storage. Due to these properties, the energy of the node decreases which affects the efficiency of the network.

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This applies a new multipath routing protocol, which is called Zone-based Leader Election Energy Constrained AOMDV Routing Protocol (ZBLE) with a zone-based routing protocol, which is a combination of zone-based and leader Election functions.

The proposed approach is different from the existing methods. In this approach, the performance of the AOMDV protocol improves performance based on the selection of zone-based leader nodes. Now whenever a sender wants to send data, every time he stores the Election of residual energy and leader nodes. Here we reduce energy conservation and increase the percentage of receiving data in the network. In traditional AOMDV, RREQs use several paths. Energy is not kept in mind to choose these paths. Here the functioning of the proposed system with the help of Figure 2 is shown by the flow chart.

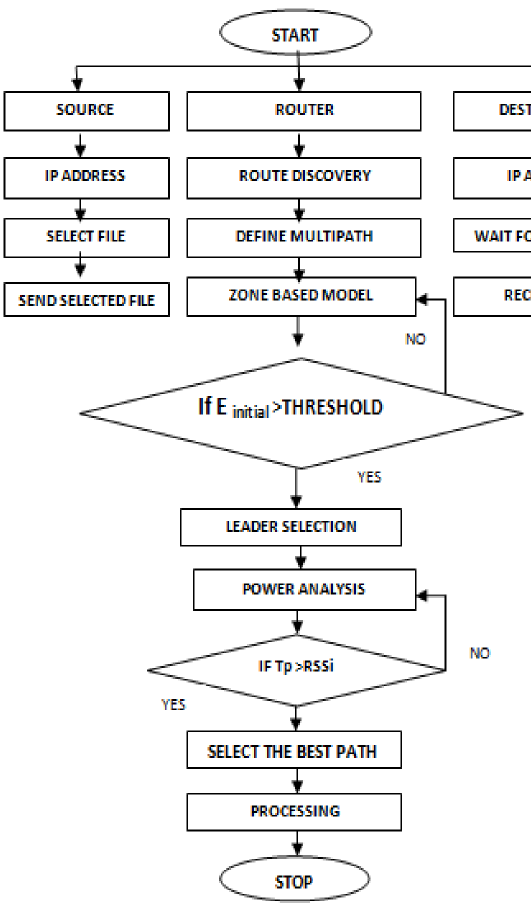

Figure 2 Flow Chart of the ZBLE

In Figure 2, we have tried to understand this technique with the help of the flow diagram. This flow diagram presents the flow of the functions described in the above-mentioned block diagram. Mobile ad-hoc is implemented using the zone-based model here. Here is some energy in all the nodes. Based on the Threshold value in this model, it has been decided that any node is capable of making the transmission. All nodes have some battery labels but the initial battery labels that we can give. Therefore, each node has been labeled the initial battery, and this energy label gradually decreases. We cannot predict energy labels. Node transmission power is obtained on the basis of its energy strength.

If the energy is lower than the power threshold, it means that a special node is not capable of transmitting due to the low amount of energy node. And any node will be capable of transmitting and communicating only when the energy is greater than or equal to the power threshold. If the value of any node is found to have a value greater than the threshold value, then it should be selected as a leader node or else go back to the zone-based model. Now the power has been analyzed. Power analysis means transmission power and reception power. If the cost of transmission power is higher than RSS (Received Signal Strength), then the route should be chosen and processed, otherwise, if it does not have any instrument then it returns power analysis.

3.3. Proposed Algorithm

The help of algorithm is showing Zone based technology in this section. Whenever we have to communicate in any network, we need to search for a source and destination. Therefore the source and destination have been initially initialized. The second stage is the mobility model. With the dynamic model, the position of the node is detected and we can easily find out the beginning and end position of all the nodes through this model. How many nodes are in every zone the Election of leader nodes and the information of neighboring nodes can also be obtained by this model, how many nodes in the range of their zones can help to forward the data. And we can also make that node a leader node. After the Election of Leader node and Zone Members, it has been checked to represent the power signal. Leader node collects forward nodes by analyzing power analysis on the basis of transmission power and reception power. The forwarder selects the forwarder node using the max density, minimum dentistry and maximum packet size in the node Election method. Using the RSS value, selecting the forward node, the best path has been selected.

Every node should have these following characteristics:

Speed: Node velocity

Power signal: Signal strength of the node

Gap: Distance between the particular node and destination

Condition 1:

Speed: Slow Power signal: High Gap: small

Condition 2:

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Speed: Medium Power signal: Medium Gap: Minimum

Condition 3:

Speed: High Power signal: Low Gap: Large

To solve the above-stated problem the following steps are performed (Algorithm 1):

Step: 1 Initialize the Network with N nodes and define source and destination

Initialization src,dst

Step: 2 Mobility model

If mi (Si Sj) , then src->nid vel(i,j) ; If , then speed (Si Sj)

Step: 3 Leader node Elections

Node_id. UpdateRange (Ei,pi)

for db in neighbhour do

If nid (Pi) , then src->nid k(i,j) ; If , then mn (Ei) nid.

Step: 4 Power analyses

Leader node analyze the power level of the neighbors in their vicinity

ni(1)+ni(2)+…ni(n)=ti(n)

ni(1)+ni(2)+…ni(n)=ri(n)

ti,ri->transmission and reception power of the node

for index in [0, ..., List.lenдth() − 1] do

group of nodes= nodeList[index]

forwarder_Election = FindCandidateSeeds(nid,nid(1))

for range in network do

node_radius = 0.075

Step: 5 Forwarder node Elections.

if (RSSI > max Density) or (new Density == RSSIand range < max Range Size) then

maxDensity,maxIndex = high_level

max_pktsize = normal_level

max_iterations = low_level

Step: 6 End Process

Algorithm 1 Proposed Algorithm

4. RESULTS AND DISCUSSIONS

In this simulation model, we have used CBR with 100 mobile nodes, which have been introduced in the 1507 meters * 732 meters network area.

The initial energy level has been set for 50 JU. We have given the simulation time like 10, 15, 20, 25, 30 seconds and the size of the node speed and packets is set to 3 m / s and 512 bytes, respectively. The simulation time is set to 30 seconds.

The Table 1 illustrates the various parameters used to perform the simulation to obtain the required results.

Scenario Elements	**Values**	**Unit**
Number of nodes	100	Nodes
Node speed	10, 15, 20, 25 , 30	Meter/second
Queue size	50	packets
Simulation area	1507 * 732	Meter2
Routing protocols	AODV, AOMDV, ZBLE	Protocol
Mobility model	Random way point	
Packet size	512	Bytes
Traffic type	CBR	
Initial energy	50	Joules
Transmission power consumption	0.035	Joules
Receive power consumption	0.035	Joules
Idle Power	0.100	Joules
Sense Power	0.0175	Joules
Simulation time	30	seconds

Table 1 Various Simulation Parameters

4.1. Packet Delivery Ratio (PDR)

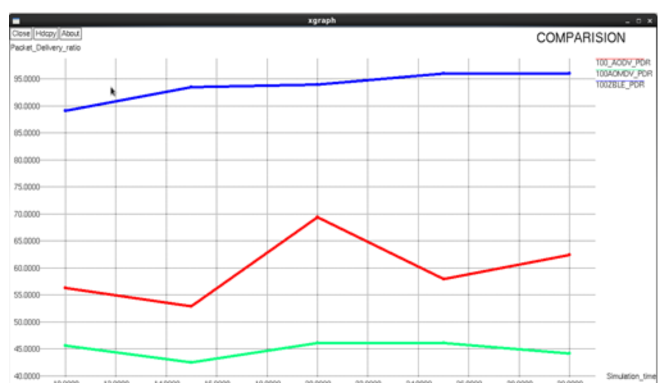

Figure 3 Graph of packet delivery ratio with simulation time

The packet's ratio of data packets generated by the source up to the packet destination node is known for the PDR.

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PDR = (number of packets received / Number of packets sent) * 100

In Figure 3, variation of the packet delivery Ratio is displayed in different simulation times via ZBLE, AOMDV and AODV protocols.

Despite the failure of any opportunity or route, ZBLE has a high PDR. These PDRs are more due to the availability of multiple paths. Packet delivery ratio increases with simulation time. ZBLE's packet delivery ratio performs better than both AODV and AOMDV protocols.

4.2. Throughput

The number of bits successfully received from the destination is called throughput.

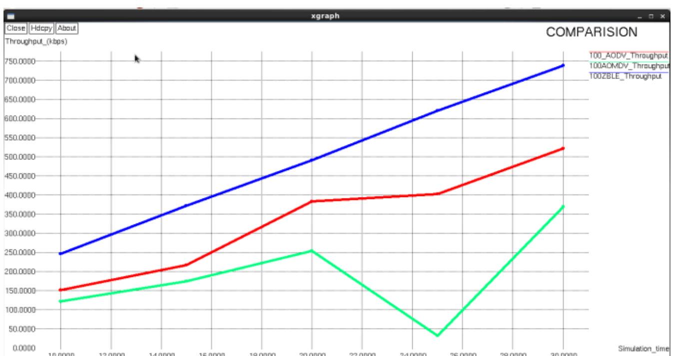

Figure 4 Graph of throughput with simulation time

In Figure 4, X-axis shows simulation time and throughput on the Y-axis. With the help of this Figure 4, we have shown the effect of throughput on different simulation times. Better performance in the throughput of the ZBLE protocol than both AODV and AOMDV protocols.

4.3. End-to-End Delay

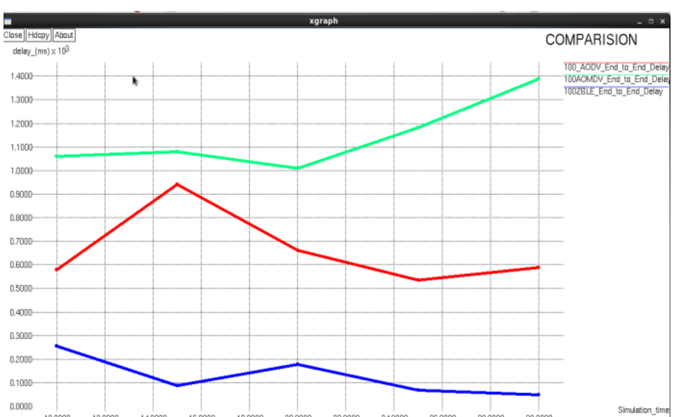

Figure 5 Graph of End to end delay with simulation time

The average time of taking the data packet generated by the source to the destination can be called an end-to-end delay. This includes many delays in the interface queue during routing latency, including buffering, transfer time, packet queue and promotion. In Figure 5 ZBLE protocol is showing better performance than AOVDV and AODV. The end-to-end delay in ZBLE is minimal because it is the most energy efficient way to avoid delays in packet transmission through multiple routes.

4.4. Energy Consumption

During the simulation time, the amount of energy consumed by the network node is known by energy consumption. Figure 6 shows graph of energy consumption in which ZBLE zone-based topology, AODV and AOMDV show the difference in energy consumption. Here ZBLE displays good performance because it is designed to choose from the source of the highest energy levels.

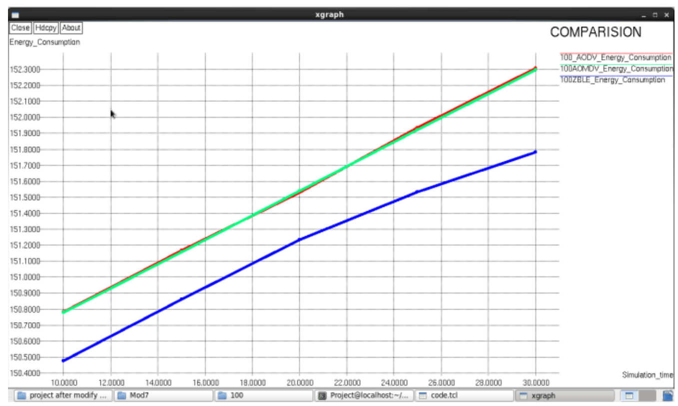

Figure 6 Graph of energy consumption with simulation time

ZBLE consume minimal energy because it contains information about most energy efficient paths. This sends the data packet to the highest energy and from the minimum source to the distance of the destination. In addition, it provides road transit facility in case of failure of any route.

4.5. Network Lifetime

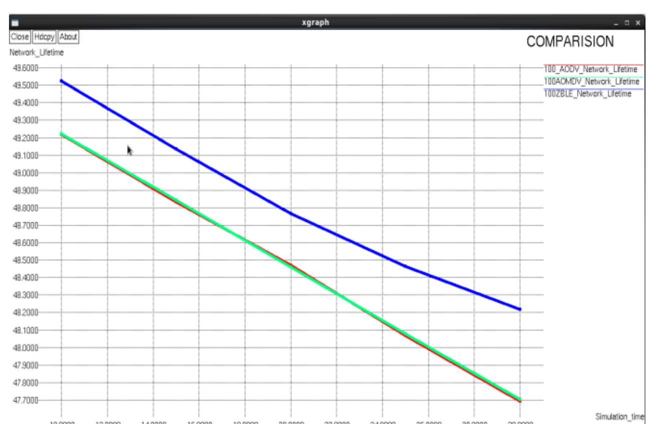

Figure 7 Graph of network lifetime with simulation time

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The time required to eliminate the battery of N mobile nodes is referred to as a network lifetime.

Figure 7 demonstrates the comparison of the lifetime of the simulation network. In this Figure 7, the x axis shows the simulation time and when the Y axis timer changes time, then the number of nodes for the ZBLE, AODV and AOMDV indicates the exhaustion. ZBLE increases the life of its network as it routes traffic to high energy nodes in the network. In case, when the energy of these nodes is exhausted, topology has the property to gather information about various energy efficient routes and hence it transfers traffic on the shortest route for the next energy efficient, thus network Enhances life.

Here we can compare performance enhancements by displaying all the enhancements in the form of tables. With the help of the following tables, we compare performance metrics on different simulation scenarios. By comparing the proposed algorithm with various existing protocols in this table, we found the ZBLE protocol best. From Table 2 to Table 6, the values of parameters: PDR, throughput, End-To-End delays, Energy Consumption, and Network Lifetime are displayed.

Simulation Time in Second	Packet Delivery Ratio (PDR)		
	AODV	AOMDV	ZBLE
10	56.3163	45.5414	89.0665
15	52.8433	42.4411	93.5023
20	69.413	46.0608	93.988
25	57.9648	46.0278	96.0229
30	62.4235	44.1706	95.9624

Table 2 Comparison of PDR

Simulation Time in Second	Throughput		
	AODV	AOMDV	ZBLE
10	150.52	121.72	245.00
15	216.20	173.64	371.55
20	382.47	253.80	490.15
25	401.62	31 8.92	619.96
30	521.08	368.71	738.42

Table 3 Comparison of Throughput

Simulation Time in Second	End To End Delay		
	AODV	AOMDV	ZBLE
10	579.79	1061.11	256.695
15	940.768	1079.9	87.9443
20	662.81	1008.82	177.819
25	535.12	1182.67	68.5571
30	588.861	1389.71	47.868

Table 4 Comparison of End To End Delay

Simulation Time in Second	Total energy consumption		
	AODV	AOMDV	ZBLE
10	150.781	150.778	150.475
15	151.168	151.157	150.863
20	151.529	151.539	151.233
25	151.933	151.921	151.534
30	152.308	152.297	151.781

Table 5 Comparison of Energy Consumption

Simulation Time in Second	Network lifetime		
	AODV	AOMDV	ZBLE
10	49.2187	49.2223	49.5255
15	48.8319	48.843	49.137
20	48.4706	48.4612	48.767
25	48.0674	48.0788	48.4656
30	47.6918	47.7026	48.2193

Table 6 Comparison of Network lifetime

5. CONCLUSION

In this research, we have proposed ZBLE (Zone-based Leader Election Energy Constructed AOMDV Routing Protocol), a protocol based on Zone Technology, which has been simulated using various simulation times using NS-2.35. These scenarios have been tested by some metrics. The results of simulations have proved that the proposed ZBLE protocol has delivered better results than modern two protocols AODV and AOMDV.

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