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Optimized Traffic And Enhanced Lifetime Routing Algorithm In Wsn

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Abstract - *The wireless innovation has taken a major jump in ongoing time and in this day and age, we are progressing towards the utilization of wireless networks. One of such network is called Wireless Sensor Network (WSN). WSN comprises of little sensor nodes; these nodes can be said the foundation of the network. These sensor nodes gather the information of their environmental factors and send this information to sink hub where it is prepared to be shipped off the control station or over the web further. To upgrade the network lifetime we have proposed the Optimized Traffic and Enhanced Lifetime routing algorithm (OTELR). We have utilized a Fuzzy Logic to compute the heuristic estimation of a hub to make it a member hub in the routing process. By utilizing this technique the hub which has less force can support the entire existence of the network as until except if any remaining nodes don't arrive at its energy level it doesn't take an interest during the time spent routing*.

Keywords-*Fuzzy Based Routing Algorithm, Optimized Traffic and Enhanced Lifetime routing algorithm, Wireless Sensor Network, Heuristic Technique*.

I. Introduction

To upgrade the network lifetime we have proposed the enhanced Optimized Traffic and Enhanced Lifetime routing algorithm (OTELR). We have utilized a Fuzzy Logic to ascertain the heuristic estimation of a hub to make it a member hub in the routing cycle. These parameters incorporate packet gathering rate, remaining energy and hub buffer state and dependent on these parameters the sink hub assesses the hub status by fuzzy principles for the current routing schedule. In the event that the heuristic estimation of the hub is not exactly the edge energy it doesn't partake all the while and network load is adjusted. A three info based fuzzy rationale algorithm produces the hub status and this is utilized as cost heuristic capacity to decide the decision of reasonable nodes to locate the optimal way. By utilizing this strategy the hub which has less force can support the entire existence of the network as until except if any remaining nodes don't arrive at its energy level it doesn't partake during the time spent routing.

Heuristic Technique

A Heuristic technique is a quick technique of arriving at an estimated esteem when the genuine worth isn't known. It is the technique of true when we don't have the specific answer for a given issue we gauge the rough worth. The heuristic technique chips away at exactly the same rationale of presence of mind.

Fuzzy logic

Fuzzy rationale has been utilized in numerous applications, for example, facial example recognition, climate control systems, clothes washers, vacuum cleaners, antiskid slowing mechanisms, and transmission frameworks, control of tram frameworks and automated helicopters, information based frameworks for multiobjective optimization of intensity frameworks.

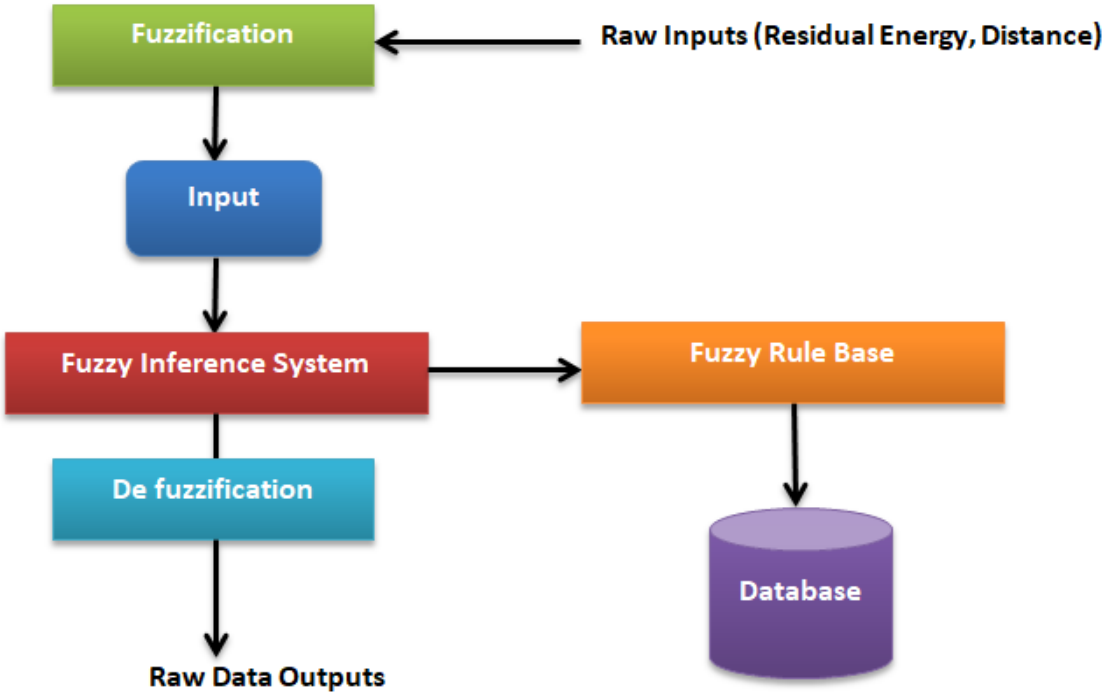

Figure 1: Fuzzy Based Routing System

Wireless Sensor Network

Wireless sensor networks (WSNs) are a community of numerous autonomous nodes that have self-energy and radio wire utilized for the interchanges with the area. Regardless of their restrictions of computation, transmission and energy, they are as yet required for various applications like monitoring, tracking, and woods fires, and so forth By and large, WSNs are conveyed in far spots and intended to work with a totally missing human intervention. Subsequently, they should fill in to the extent that this would be possible. This presents the requirements for novel energy the executives strategies, as such, how to limit the energy utilization. There are three kinds of energy utilization: computation, detecting, and during the transmission and gathering of information detected by the network. Among them, the correspondence takes the greatest measure of energy. Most analysts have focused on prolonging the lifetime to the detriment of the nature of administration (QoS) and different imperatives. A WSN that has a long lifetime, however with an awful nature of administration (for example an awful Packet Delivery Ratio (PDR)) will be powerless paying little mind to the application. In this work, we will broaden the network lifetime by thinking about both the excess energy (RE) of every way just as its Packet Error Rate (PER) to keep a superior nature of administration utilizing the fuzzy rationale approach.

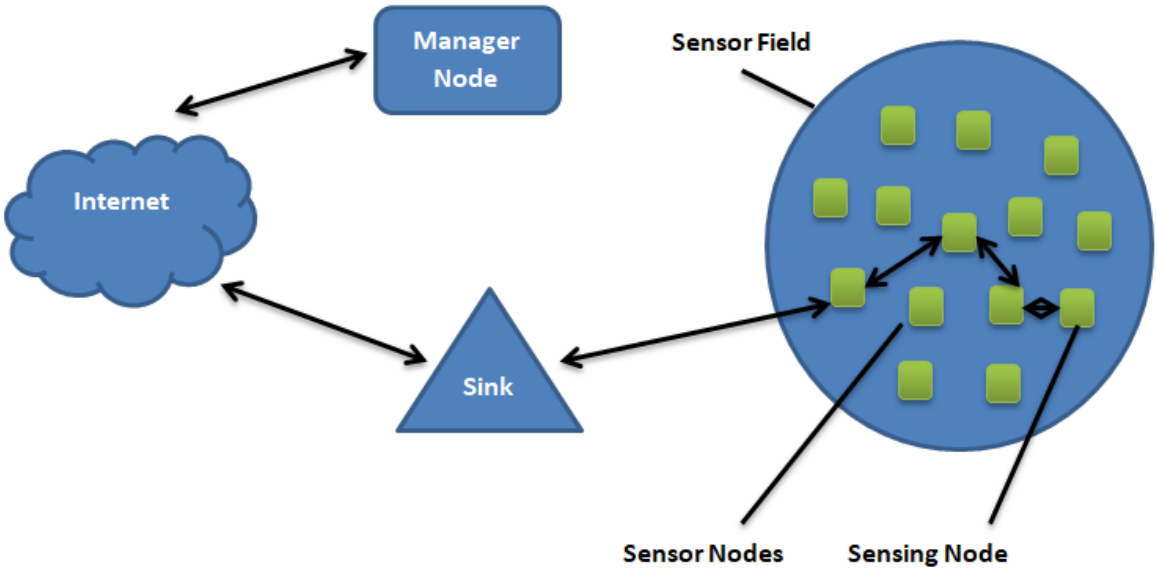

Figure 2: Wireless sensor networks

Routing

The majority of the hub energy is debilitated by radio transmission. Force investment funds in radio transmission are typically accomplished by energy proficient medium access and routing protocols. Give the most extreme achievable dependability - use opportunity courses if a halfway hub falls flat. Give the nodes the top of the line achievable reaction time and throughput. Each hub should have brisk admittance to courses on interest. In customary wired networks every hub is distinguished by an interesting location, which is utilized for routing. Sensor networks, being data driven do no more, in norm, require routing among remarkable nodes. Neighboring nodes may likewise have similar information. So its miles wonderful to mix these realities and send it.

Essentially there are two sorts routing protocols dependent on its network structure as level based and cluster based. In cluster based routing convention sensor nodes are assembled into clusters with one hub is chosen as cluster head for each cluster. Sensor nodes in the cluster are communicating their detected data the cluster head. The cluster head measure the information and play out the information aggregation from the gathered sensor nodes.

Many routing algorithms have been proposed for WSN to amplify the network lifetime by upgrading the energy utilization. Wireless sensor network requires energy proficient and solid routing protocols. Multi-way routing algorithms have been proposed to augment the solid transmission of an occasion recognized by sensor nodes.

Issues in WSN

i. Design Issues

- Fault – tolerant Communication: Due to the organization of sensor nodes in an uncontrolled or unforgiving climate, it isn't remarkable for the sensor nodes to get faulty and inconsistent.
- Low dormancy: The occasions which the framework manages are earnest which should be perceived promptly by the administrator. Accordingly, the framework needs to detect and advise the occasions rapidly as quickly as time permits.

- Scabability:A framework, whose exhibition improves subsequent to adding hardware, relatively to the limit added, is supposed to be an adaptable framework. The quantity of sensor nodes conveyed in the detecting zone might be in the request for hundreds or, at least thousands.
- Transmission Media:In a multi-bounce sensor network, imparting nodes are connected by a wireless medium. The traditional issues related with a wireless channel (e.g., blurring, high blunder rate) may likewise influence the operation of the sensor network.

ii. Topology Issues

- **Geographic Routing:** Geographic routing is a routing rule that depends on geographic position data. It is principally proposed for wireless networks and dependent on the possibility that the source makes an impression on the geographic area of the objective instead of utilizing the network address.
- **Sensor Holes:** A routing opening comprises of an area in the sensor network, where either hub are not accessible or the accessible nodes can't partake in the genuine routing of the information because of different potential reasons. The undertaking of distinguishing openings is particularly testing since average wireless sensor networks comprise of lightweight, low-ability nodes that are ignorant of their geographic area.
- **Coverage Topology:** Coverage issue reflects how well a zone is checked or followed by sensors. The inclusion and availability issues in sensor networks have gotten significant consideration in the examination network lately. This issue can be defined as a choice issue, whose objective is to decide if each point in the administration zone of the sensor network is covered by in any event k sensors, where k is a given boundary.

iii. Other Issues

The significant issues that influence the plan and execution of a wireless sensor network are as per the following:

- Hardware and Operating System for WSN
- Wireless Radio Communication Characteristics
- Medium Access Schemes
- Deployment
- Localization
- Synchronization
- Calibration
- Network Layer
- Transport Layer
- Data Aggregation and Data Dissemination
- Database Centric and Querying
- Architecture
- Programming Models for Sensor Networks

In this stage we have utilized a Fuzzy Logic to calculate the heuristic value of a node to make it a member node in the routing process. By utilizing this strategy the node which has less force can support the entire existence of the network as until except if any remaining nodes don't arrive at its energy level it doesn't take an interest in the process of routing.

Challenges in WSN

i. Challenges in real time:

WSN manages genuine conditions. By and large, sensor data should be conveyed inside time constraints so that proper perceptions can be made or activities taken. Not many results exist to date with respect to meeting ongoing requirements in WSN. Managing constant normally recognizes the requirement for separated administrations, e.g., routing arrangements need to help various classes of traffic; ensures for the

significant traffic and less help for insignificant traffic. It is significant not exclusively to grow constant protocols for WSN, yet related examination techniques should likewise be created.

ii. Challenges in power managements

Minimal effort sending is one acclaimed preferred position of sensor networks. Restricted processor data transfer capacity and little memory are two doubtful constraints in sensor networks, which will vanish with the advancement of fabrication techniques.

iii. Network Scale and Time-Varying Characteristics of WSN

Under serious energy constraints, Sensor nodes operate with restricted processing, stockpiling and communication capacities. Contingent on the application, the densities of the WSNs may change generally, going from inadequate to exceptionally thick. Moreover, the sensor nodes might be requires changing the behavior in light of the inconsistent and unpredictable behavior of wireless associations brought about by high commotion levels and radio-frequency interference, to forestall extreme execution degradation of the application upheld.

II. Existing System

1. S. R. Das. et.al, proposed Ad hoc On-demand Multipath Distance Vector Routing

The objective of the protocol Ad hoc On-request Multipath Distance Vector Routing (AOMDV) is to stretch out the AODV to locate multiple disjoint and liberated from loops routes among source and objective, rather than just one route. After discovering the first route to the objective, the source begins to utilize it. Any remaining routes discoveries are left as backup routes. The origin will attempt to utilize one of these routes if the current is broken. The AOMDV comprises of the following partsroute discovery and route maintenance. The source starts a route discovery by sending a route demand message (RREQ) in broadcast. From the second that the RREQ is shipped off the whole network, a node may get multiple copies of a similar RREQ. These multiple copies might be utilized to frame alternative converse way. In this way, all the copied copies are inspected in AOMDV, those copies that save the freedom of trim and have disjoint paths among source and objective might be utilized to frame alternative paths. To look after routes, AOMDV utilizes the error messages route error (RERR). A node produces and advances a RERR to the source when it distinguishes a wrecked connection. At the point when you get a message RERR, the source just picks another way to the objective and keeps the routing data. In the event that there are no routes accessible, the source should restart the route discovery process. Every passage in the routing index contains a rundown of the following jump alongside the quantity of bounces (bounce tally) to every objective. Other than keeping up multiple loop-free paths, the AOMDV plans to discover alternative disjoint paths between couples of nodes. The utilization of disjoint routes expands fault tolerance, since the probability of concurrent disappointments is more modest in comparison to the utilization of alternative shared pathways. For AOMDV, any way between a couple of nodes that don't have regular nodes or links is viewed as disjoint.

2. Anfeng Liu ,Ju Ren et.al, proposed Cost Function Based Routing Algorithms

The minimum total energy (MTE) routing approach was proposed. This methodology limits the total consumed energy to arrive at the sink. Notwithstanding, if all the traffic is routed utilizing the minimum energy route, the nodes on that route will exhaust their energy rapidly causing network partition while different nodes actually have a lot of energy. In this manner, since MTE doesn't think about the excess energy of the nodes, it can't adequately broaden the lifetime of the network. Min-Max Battery Cost Routing, MMBCR, proposed by Singh, considers as its metric the residual battery capacity. The nodes with high battery capacity are allowed to take on routing tasks more regularly than the nodes with low battery capacity. MMBCR expands the lifetime of the nodes without ensuring that the total consumed energy is limited over the chose route. The Conditional Min Max Battery Cost Routing (CMMBCR) considers both the minimum total energy consumption of routes and the leftover energy of nodes. In a new work, the creators propose another

energy cost work and another start to finish postpone work which are utilized to decide the lowest cost route from cluster heads to the sink. This work aims to achieve the best tradeoff between minimizing energy consumption and minimizing delay in cluster-based multi-hop routing.

Proposed System: Optimized Traffic and Enhanced Lifetime routing algorithm

The capability of fuzzy logic has been completely investigated in numerous fields including signal processing, speech recognition, aerospace, robotics, embedded controllers, networking, business and marketing. In addition, the utilization of FL in WSNs is demonstrated to be a promising technique since it permits consolidating and assessing assorted boundaries in a proficient way. FL is a decent approach as its execution requirements can be handily upheld by sensor nodes, while it can improve the general network execution. In WSNs, fuzzy logic has been utilized in localization, clustering and cluster head election, routing, data aggregation, security, and so forth.

The CH selection in Optimized Traffic and Enhanced Lifetime routing algorithm depends on the CH role rotation approach, where the hub i turns into a CH in the current round r, if the random number chose by the hub i is not exactly the threshold T(i,r).

$$\boldsymbol{T(i,r)} = \begin{cases} \dfrac{\boldsymbol{p_i(r)}}{\boldsymbol{1-p_i(r)\left(r \bmod \frac{1}{p_i(r)}\right)}} & \textbf{if node i} \in \boldsymbol{G(r)} \\ \boldsymbol{otherwise}\ \boldsymbol{0} \end{cases} \text{---------- (1)}$$

Where p_i (r) is the CH selection probability for hub i during round r.(r)Is a bunch of qualified nodes for the round r, where the turning age for hub i to become qualified again is1/p_i (r). Randomly distributed energy heterogeneity and inclines toward nodes with higher initial and remaining energies for CH role, for example an energy-rich hub has higher p_i (r)and higher odds of turning out to be CH. As the activities of a CH are energy concentrated, favoring nodes with higher initial energies and higher lingering energies improves the life of energy more vulnerable nodes and consequently it improves the WSN soundness period. Area IIIA talks about that an expansion in traffic loads expands the compelling number of pieces to be conveyed to the BS and thus builds network energy consumption. In traffic heterogeneous situation, the pace of energy consumption is higher for the nodes with higher traffic loads. Along these lines, it is logical that such nodes should be evaded for energy escalated activity, e.g., CH role. For a sensible WSN model, with the nodes having heterogeneous initial energies and data traffic requirements, the proposed Optimized Traffic and Enhanced Lifetime routing algorithm favors the nodes with higher energies (initial and lingering) and evades the nodes with higher traffic loads for CH role. In Optimized Traffic and Enhanced Lifetime routing algorithm, the probability of turning out to be CH for hub i during round r is characterized as

$$\boldsymbol{p_i(r)} = \frac{\boldsymbol{p_{opt}.N(1+a_{ehi})N(1+a_{th}-a_{ehi})E_i(r)}}{\boldsymbol{(N+\sum_{i=1}^{N} a_{ehi})(N+Na_{th}-a_{Tot})E_{Avg}(r)}} \textbf{(2)}$$

Where $E_{Avg}(r)$ is average energy of the round and $\boldsymbol{p_{opt}}$ is optimal probability of a node to become CH, given by $\boldsymbol{p_{opt}} = \frac{\boldsymbol{k_{opt}}}{\boldsymbol{N}}$. The leftover functionality of Optimized Traffic and Enhanced Lifetime routing algorithm is like DEEC. Further, without traffic heterogeneity, Optimized Traffic and Enhanced Lifetime routing algorithm falls back to DEEC behavior. In light of DEEC, the $\boldsymbol{E_{Avg}(r)}$is given by

$$\boldsymbol{E_{Avg}(r)} = \frac{\boldsymbol{1}}{\boldsymbol{N}}\boldsymbol{E_{Tot}}\left(\boldsymbol{1}-\frac{\boldsymbol{r}}{\boldsymbol{R}}\right); \boldsymbol{where\ R} = \frac{\boldsymbol{E_{Tot}}}{\boldsymbol{E_{Round}}} \quad (3)$$

Where R is the assessed value of network lifetime regarding the number of rounds dependent on uniform energy waste in each round. In real situation, the network energy may not deplete in a uniform way and few nodes stay alive for $r>R$. In light of (16), when r approaches R, E_Avg (r)becomes a tiny quantity and for $r>R$ it turns into a negative quantity.

In our proposed work, we have utilized a fuzzy logic based enhanced Lifetime routing algorithm in finding the best way from source node to destination node-At the initial stage every node sends its parameters: packet reception rate, residual energy and node support state to the sink node. In light of these parameters the sink node assesses the node status by fuzzy rules for the current routing schedule. In the event that heuristic perusing of node is not exactly the threshold value, it doesn't partake in the process and network load is adjusted. A three information based Fuzzy logic algorithm generates the node status and this is utilized as cost heuristic function to decide the decision of suitable nodes to discover ideal way.

Our proposition is to send data packets to nearest sensor node which has high residual energy, high packet reception rate and high free cushion. These parameters are determined utilizing fuzzy logic as given therefore and a surmised (Heuristic) value is obtained.Thelowest heuristic value is chosen and this is supposed to be the threshold value. All the nodes having the heuristic value more noteworthy than the threshold value are considered for investment in the routing process.All different nodes are left during this round routing process and they don't partake in current routing process. Furthermore, in the following round as the threshold value is brought down; another rundown of taking an interest nodes is ready for investment in the new round of routing process. To accomplish this we use previously mentioned parameters in a fuzzy evaluation system of the standardized information proportions given as:

node_status(n)= fuzzy_evaluation_function_of{(Eres(n)/Eini(n)),(Nr(n)/Nt(n)),(Bf(n)/Bini(n))} (4)

Where,

Eres (n)	energy (residual) of node n
Eini (n)	energy (initial) of node n
Nr (n)	number of received packets
Nt (n)	number of transmitted packets
Bf (n)	fixed free buffer
Bini (n)	initial free buffer

In the fuzzy rules higher weightage is given to parameters residual energy of node.The value of distance function,

h(n) is calculated as h(n) = 1/Min(hcns) (5)

Here, Min (hcns) = hop count (minimum) from initial node(n) to the sink node. For figuring the minimum hop count, we need to calculate the distance from initial node(n) to sink node:

$$d(n,s) = \sqrt{(xn-xs)^2 + (yn-ys)^2}\ 2.3$$

To calculate the minimum hop count:

hcns = d(n,s)/avgd(n,j) (6)

Where, avegd (n, j) is the distance(average) between node n and its quick neighbor node j.The energy consumed for transmitting and receiving k piece data can be assessed as

$$Etx\ (k) = k(Eelec + \varepsilon amp.d^2) \quad (7)$$

$$Erx\ (k) = k(Eelec) \quad (8)$$

Where, Eelec = energy per bit disseminated in transmitting and receiving and εamp = energy per bit per meter square needed for intensifier to accomplish acceptable S/N ratio.

$$\textbf{Total energy} = k(2E_{elec} + \varepsilon_{amp} \cdot d^2) \quad (9)$$

Proposed Optimized Traffic and Enhanced Lifetime routing algorithm

Step 1: Start

Step 2: Distribute position to Sensor Nodes in territory A * A

Step 3: Route discovery from nodes to sink

Step 4: Nodes sending packets to the sink through set up route

Step 5: Sending parameters of nodes i.e., Residual energy packet reception rate and node buffer state.

Step 6: Apply fuzzy interference systems based assessment of nodes status

Step 7: If Node status> Threshold

Step 8: Discard the node in routing

Step 9: Else, Select as next neighbor for routing

Step 10: End.

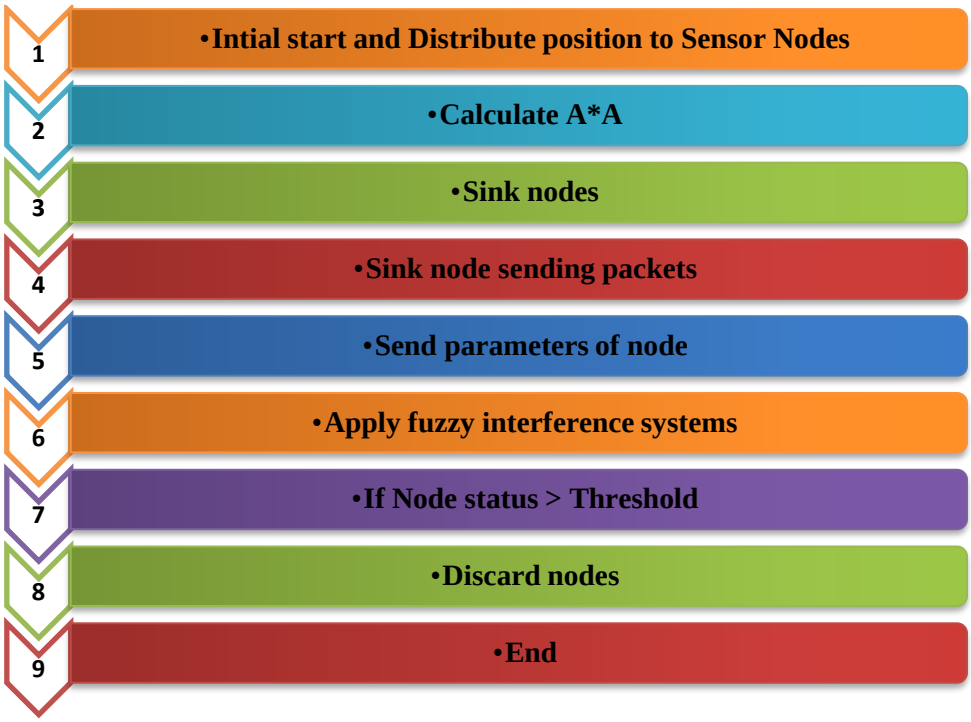

Figure 3: Flow diagram for Proposed Method

In the present circumstance, a few nodes kick the bucket early while some bite the dust late. So a considerable lot of the time, critical nodes would regularly pass on the grounds that they are more dynamic in the network. By applying this threshold value function, we have limited the heap of these critical nodes. So at whatever point the energy level of these critical nodes fall beneath the threshold value, they don't partake in communication process and the other close by nodes with higher threshold value assume control over the charge. With the assistance of fuzzy logic based Enhanced Lifetime routing algorithm we discover optimum path.Here we have recommended a method of improving this lifetime by utilizing WSN Cost Heuristic Function utilizing Fuzzy Logic Enhanced Lifetime routing algorithm. This algorithm has improved the selection of nodes in communication process.

Experimental Result

The proposed Optimized Traffic and Enhanced Lifetime routing algorithm (OTELR) algorithm has been assessed utilizing MATLAB. The algorithm has been tried widely with other existing algorithms and the experimental results are introduced. The Optimized Traffic and Enhanced Lifetime routing algorithm (OTELR) algorithm results are contrasted and other existing algorithms like AOMDV and MMBCR algorithms. The recreation boundaries utilized in the proposed work are given in Table1.

Parameter	Value
Area	200×200m^2
Sensor nodes	100-1000
Initial energy	0.5 J
E_{elec}	50 nJ/bit
E_{fs}	10 pJ/bit/m^2

E_{mp}	0.0013 pJ/bit/m^4
Packet size	4000 bits

Table 1: Simulation Parameters.

1. Network LifeTime

Number Of Nodes	AOMDV	MMBCR	OTELR Algorithm
100	250	275	310
200	320	345	380
300	340	360	390
400	370	390	410
500	410	440	470

Table 2: Comparison table of Network LifeTime

Table 2 shows the comparison table of Network LifeTime. In number of nodes are 100 the network lifetime of AOMDV is 250, MMBCR is 275 and the proposed algorithm has 310. It is seen from the results that our proposed algorithm has preferred network lifetime over AOMDV and MMBCR.

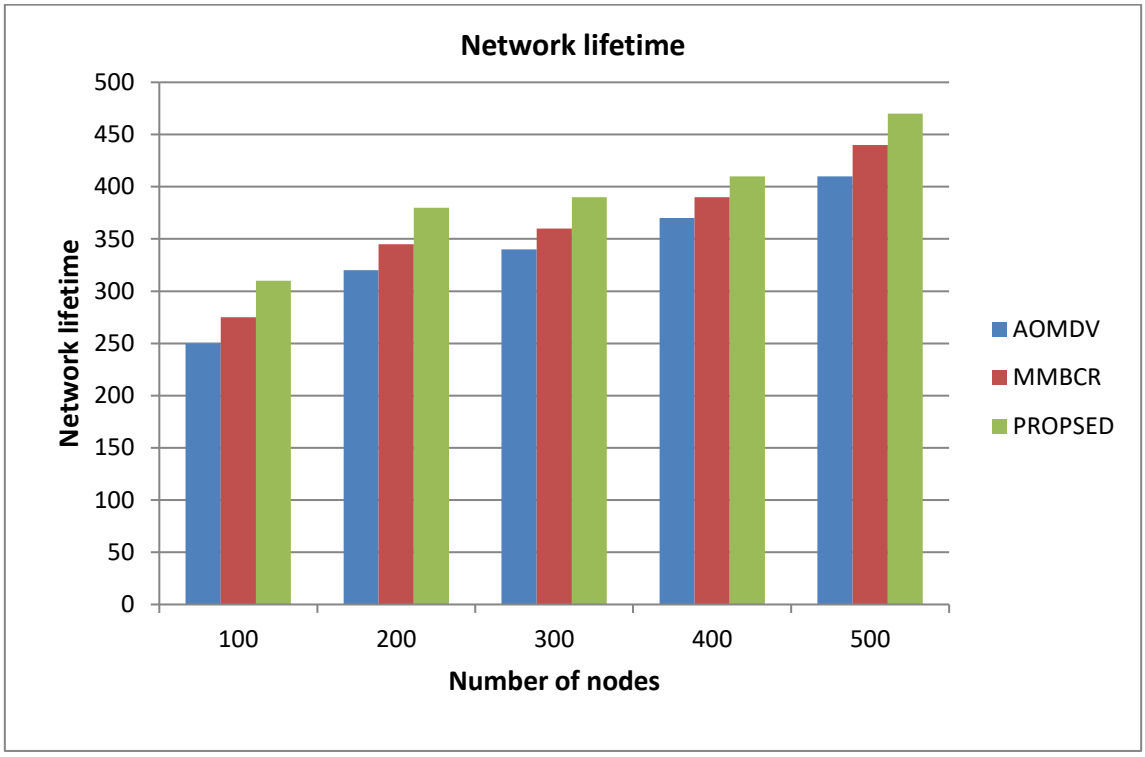

Figure 4: Comparison chart of Network Lifetime

The comparison of network lifetime for different number of nodes is introduced in Fig. 4. It is seen from the results that our proposed algorithm has preferable network lifetime over AOMDV and MMBCR. When contrasted with different algorithms in OTELR utilizing Fuzzy rules, the lifetime of the sensor nodes increments when the quantity of nodes increments. The explanation for this is the energy of the sensor nodes is adjusted.

2. Average Energy Consumption

Number Of Nodes	AOMDV	MMBCR	OTELR Algorithm
200	0.45	0.43	0.4
400	0.42	0.41	0.37
600	0.39	0.37	0.33
800	0.35	0.33	0.29
1000	0.32	0.31	0.25

Table 3: Comparison table of Average Energy Consumption

Table 3 shows the comparison table of Average Energy Consumption. In number of nodes are 200 the Average Energy Consumption of AOMDV is 0.45, MMBCR is 0.43 and the proposed algorithm has 0.40. It very well may be seen from the table that our proposed algorithm has less energy devoured than different algorithms AOMDV and MMBCR.

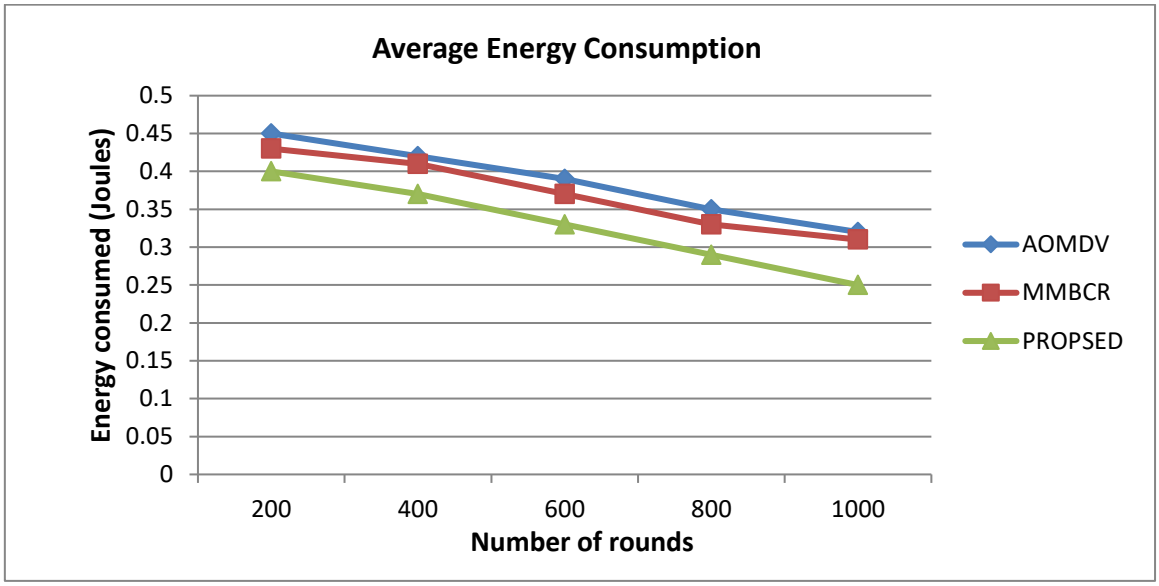

Figure 5: Comparison chart of Average Energy Consumption

In Figure 5, the average energy overwhelmed by regard to the quantity of rounds is shown. In number of nodes are 200 the Average Energy Consumption of AOMDV is 0.45, MMBCR is 0.43 and the proposed algorithm has 0.40. It tends to be seen from the figure that our proposed algorithm has less energy burned-through than different algorithms.

3. Number of Alive Nodes

Number Of Nodes	AOMDV	MMBCR	OTELR Algorithm
100	100	100	100
200	99	100	100
300	98	100	100
400	76	88	99
500	71	87	95

Table 4: Comparison table of Number of Alive Nodes

Table 4 shows the comparison table of Number of alive nodes. After 500 rounds, in AOMDV just 71 nodes are alive, in MMBCR it is 87 nodes. Yet, in the proposed OTELR algorithm 95 nodes are alive, which is higher than any remaining algorithms.

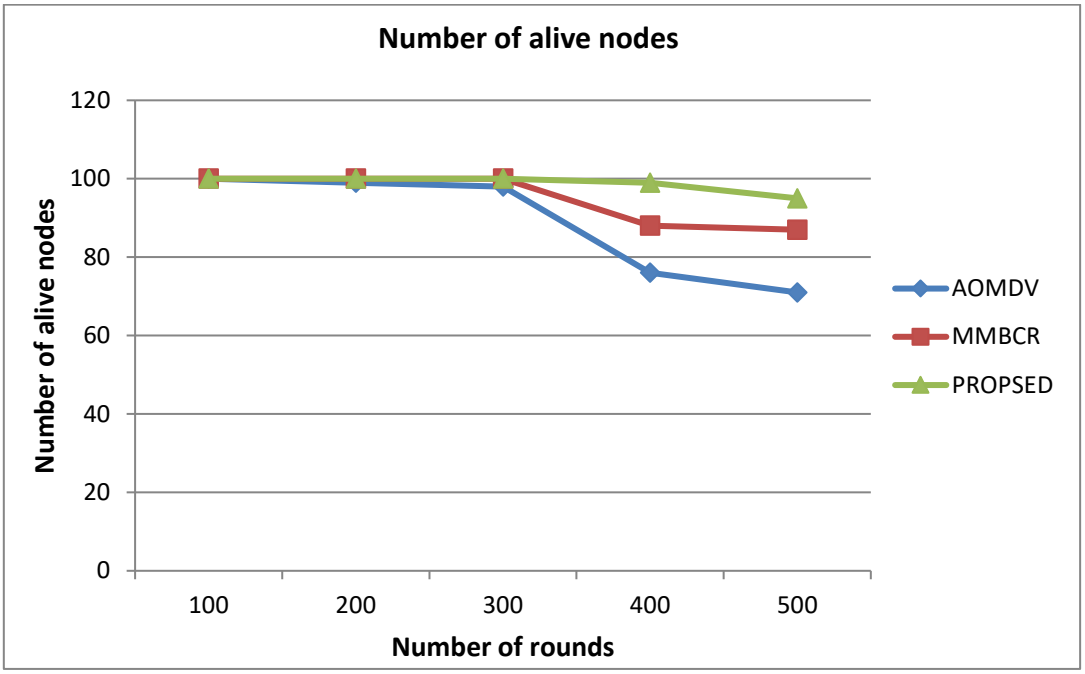

Figure 6: Comparison chart of Number of Alive Nodes

From Figure 6, it is seen that the proposed algorithm performs in a way that is better than different algorithms. After 500 rounds, in AOMDV just 71 nodes are alive, in MMBCR it is 87 nodes. Be that as it may, in the proposed OTELR algorithm 95 nodes are alive, which is higher than any remaining algorithms. The primary explanation for that is in the proposed approach fuzzy rules are utilized for routing. So by the utilization of fuzzy rules the sensor nodes are chosen and in this way the energy is adjusted. Subsequently, for significant stretch of time, the more number of nodes are alive in the proposed work when contrasted and different algorithms.

4. Throughput

Number Of Nodes	AOMDV	MMBCR	OTELR Algorithm
100	90	95	100
200	85	89	99
300	81	85	94
400	76	79	89
500	69	72	80

Table 5: Comparison table of Throughput

Table 5 shows the comparison table of Throughput. After 500 rounds, in AOMDV just 69 throughput, in MMBCR it is 72 throughput. Be that as it may, in the proposed OTELR algorithm 80 throughput, which is higher than any remaining algorithms.

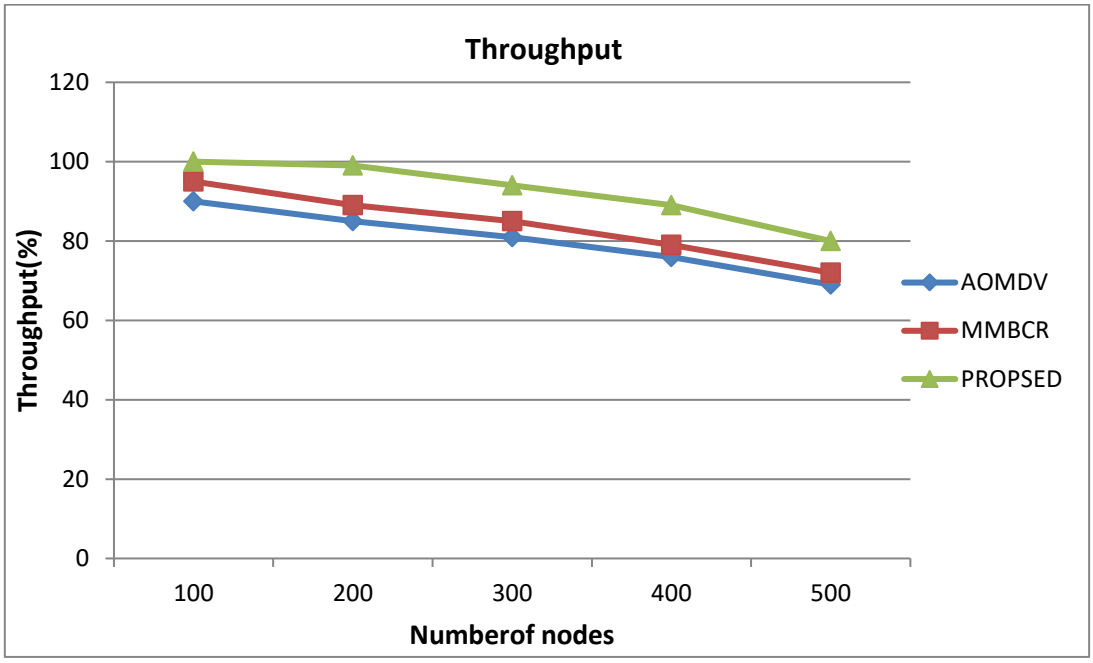

Figure 7: Comparison chart of Throughput

Figure 7 shows the throughput examination between the proposed algorithm and the current algorithms. From this graph, it is seen unmistakably from the figure that in the proposed work has preferable throughput over AOMDV and MMBCR.

Conclusion

In most WSN deployments, broadening network lifetime is the fundamental plan objective of routing protocols. To accomplish this goal, energy-mindful routing protocols should be intended to make a proper compromise between energy productivity and energy consumption balancing among the sensor nodes. As the lifetime of hub is significant part of Wireless Sensor Network to support it for a more extended time. Here we have recommended a method of improving this lifetime by utilizing WSN Cost Heuristic Function utilizing Fuzzy Logic Optimized Traffic and Enhanced Lifetime routing algorithm (OTELR). This algorithm has improved the determination of nodes in correspondence measure. While choosing a hub for cooperation in correspondence measure, this algorithm chooses that hub whose energy is over edge esteem consequently it has additionally done load balancing in the network.

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