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ON WIRELESS SENSOR NETWORK LIFETIME PROLONG AND EFFICIENT ROUTING BY ENERGY PATH BALANCING

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Abstract:

Wireless sensor networks (WSN) companies specialized transducers that provide sensing services to Internet of Things (IoT) gadgets with restrained power and storage sources. Since alternative or recharging of batteries in sensor nodes is almost not possible, strength consumption becomes one of the important layout issues in WSN. Clustering algorithm plays an vital role in electricity conservation for the energy restrained network. Choosing a cluster head can accurately balance the burden inside the network there by reducing power intake and improving lifetime. In this challenge, we gift an energy-aware clustering for wireless sensor networks the use of EARR (Energy Aware Routing and Relay Relocation) set of rules that is applied on the WSN. The protocol takes under consideration both power performance and transmission distance, and relay nodes are used to relieve the immoderate power intake of the cluster heads. The proposed protocol effects in higher dispensed sensors and a properly-balanced clustering gadget improving the community's lifetime. The EARR method carries two protocols, which include MCP based totally EAR and Relay Relocation primarily based EAR. In segment I, Transmission range adjusting by the initializing the Maximum Capacity Path based multi hop routing by using imposing Energy Aware Routing. For the EAR implementation, want to calculate the nodes Initial Energy, Residual Energy and Optimum power path. These parameters will ensure the green path and CH hierarchy to enhance the community overall performance in addition to lifetime. The algorithm and the simulation and compare the present R-LEACH and proposed EAR-MCP technique in terms of throughput, residual strength and latency with the aid of using NS2 simulator.

Index Terms— WSN, IoT, CH selection, Residual energy, Lifetime, Energy efficient.

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I. INTRODUCTION

A wireless sensor network (WSN) is a private computer network which includes spatially dispensed self-sufficient devices using sensors to cooperatively monitor bodily Environmental conditions, inclusive of temperature, sound, vibration, pressure, movement or pollutants, at special places. The improvement of wi-fi sensor networks become at the start stimulated by using military packages along with battlefield surveillance. However, wireless sensor networks for the time being are used in lots of civilian software areas, along with environment and habitat tracking, healthcare programs, domestic automation, and site visitors manage.

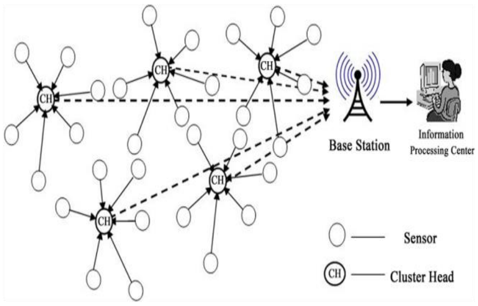


Fig.1 WSN Cluster Formation

Among the clustering set of rules, LEACH (Low Energy Adaptive Clustering Hierarchy), fig.1 is a classical protocol that considers strength for hierarchical routing of facts. The network is grouped into clusters, and the sensor node transmits its information to the corresponding CH. The protocol randomly selects CHs in a stochastic way for each round. The CH communicates with each node of the cluster called member nodes to accumulate the sensed statistics. The CH assigns TDMA (Time Division Multiple Access) schedules to its corresponding cluster member. The member node can transmit statistics at a few degree in the allocated time slot. The data is then checked for redundancy and compressed in advance than speak me with the sink node The CHs straight away communicate with BS in LEACH protocol; therefore the electricity intake in sending data from CH to BS can be more in contrast to the communiqué many of the CHs.As a result, the CHs will exhaust its power inside a brief time period. Multi-hop communiqué, alternatively, can be beneficial to triumph over this trouble, however nevertheless no longer powerful in instances of small networks. Electing a CH is a complicated task as various factors have to be taken into consideration for selection of exceptional node inside the cluster. The elements include the gap between nodes, residual power, mobility and throughput of every node. LEACH set of guidelines complements the existence of the network in evaluation to direct or multi-hop transmission however though has many limitations. The election of cluster heads is executed randomly which does no longer make certain right distribution and maximum useful solution. The nodes with lesser energy have equal priority as that of those with a better electricity diploma to be elected as CH. So, while a node of low residual energy receives selected to characteristic CH, it dies out brief ensuing in shorter community span. This project goal to select the CH thinking about important parameters similar to the initial strength, final electricity of the individual node and the finest amount of CHs within the community. The modification is performed within the classical LEACH set of rules. With the of completion of every round, the residual energy of the non-CH nodes are checked, and the only with the better power stage in assessment to others has a higher possibility for CH choice for the current-day spherical. This could save you the network to die out too early thereby enhancing the community lifetime.

II. RELATEDWORK

Mahajan, and R. M. Hegde, [1 In this paper, we utilize a recent development in social networks called small world traits for offering a singular method of joint localization and data gathering over WSN. A small international WSN is developed by using introducing records MULEs (cellular ubiquitous LAN extensions) right into a traditional WSN. Small world WSN famous low average route period and high average clustering coefficient. Such a small world WSN whilst designed with novel routing strategies ends in decreased hop counts in sensor information transmission. Additionally, a method for gold standard information MULE allocation is also developed. This technique minimizes an objective feature that's a normalized weighted sum of network parameters like bandwidth requirement and localization mistakes. The most effective data MULE allocation approach computes both the top of the line range of records MULEs and their placement within the community.

S. Kurt, H. U. Yildiz, [2] a detailed link layer version by way of using the characteristics of Tmote Sky WSN nodes and channel traits based on real measurements of SG path loss for numerous environments. A novel Mixed Integer Programming (MIP) framework is created by using the aforementioned link layer model for WSN lifetime maximization by way of joint optimization of transmission energy stage and information packet size. We analysed the WSN performance by systematic exploration of the parameter area for diverse SG environments through the numerical answers of the optimization model.

T. Liu, T. Gu, [3], the problem of power balanced statistics collection in wireless sensor networks, aiming to stability electricity consumption amongst all sensor nodes at some point of the information propagation technique. Energy balanced data collection can doubtlessly store electricity consumption and lengthen network lifetime, and therefore it has many sensible implications for sensor community layout and deployment. The conventional hop-by way of-hop transmission version lets in a sensor node to propagate its packets in a hop-by using hop manner towards the sink, resulting in negative energy balancing for the whole community. To deal with the problem, we follow a slice primarily based strength version, and divide the problem into inter-slice and intra-slice strength balancing problems. P. Nayak and B. Vathasavai, [4] modern researchers have brought about the proposition of many numerous clustering algorithms. However, maximum of the proposed algorithms overburden the cluster head (CH) for the duration of cluster formation. To conquer this hassle, many researchers have provide you with the concept of fuzzy good judgment (FL), which is applied in WSN for choice making. These algorithms focus on the efficiency of CH, which can be adoptive, flexible, and smart sufficient to distribute the load most of the sensor nodes which can decorate the community lifetime. But unfortunately, most of the algorithms use type-1 FL (T1FL) version. In this paper, we advise a clustering algorithm on the idea of c language type-2 FL model, waiting for to handle unsure degree decision better than T1FL version.P. Cheng, Y. Qi, K. Xin, [5] kingdom estimation is of first-rate importance in numerous programs primarily based on wireless networked manage structures. Wireless sensor node commonly forwards its facts to a faraway receiver thru a series of relay nodes with the intention to shop its limited power. In this paper, we look at the information forwarding strategy layout for correct far flung kingdom estimation in multi-hop wireless networks. Stability circumstance, estimation performance and strength performance of both the two techniques are theoretically analysed. We in addition advocate an Event-induced Forwarding Strategy (EFS) that's able to stability the estimation accuracy and relay power consumption. Numerical examples are employed to demonstrate the effectiveness of our design.

III. EXISTING METHODOLOGY

One of the primary issues of IoT is to deal with a huge variety of sensors that will be deployed, in terms of the fee of servicing and upkeep. Further changing sensor batteries that are already positioned in the community subject can be a tedious job. For instance, in case a sensor is to be deployed on a certain animal or species, it calls for the battery of the sensor to survive the animal that is far extra practicable. LEACH protocol has intensively been modified by way of researchers to enhance the community overall performance. Technical researchers are contributing vigorously in enhancing current algorithms for better performance of the IoT device. An strength-green believe derivation method was discussed for WSN-based IoT networks. The scheme makes use of danger strategy analysis to lessen network overhead by way of deriving an premiere quantity of hints.

- The existing R-LEACH clustering algorithm that involves two tiers: set-up and steady-kingdom degrees.
- In set-up phase, the sensor nodes are deployed inside the network and are sub-divided into clusters headed by means of a CH responsible for the collection of facts from sensing nodes.
- Actual records routing takes place at some stage in the regular-kingdom degree, where the accrued statistics is forwarded to the BS by means of the CHs of the network.

IV. PROPOSED METHODOLOGIES

The EARR scheme specifically specializes in when the relay node will be brought about to perform the relocation method and in which to move to. Besides the sink relocation scheme, the whole operation of the WSNs for environment tracking additionally desires to incorporate the routing technique for reporting the sensed records from the source to the relay (sink), as well as the energy intake version. In this phase I record, we are able to first off in brief describe the strength consumption model for message relaying. Then, the electricity-aware routing approach (the MCP) that is followed in the EARR technique can be illustrated the usage of a routing instance. At the give up of this file, some related studies works for efficient routing can also be addressed.

In this assignment change, we use a dynamic routing protocol, known as Maximum Capacity Path (MCP), as the underlying routing protocol of the proposed Energy Aware routing technique.

The MCP mainly consists of 3 process steps. They are,

- Layering graph G right into a layered community N;
- Determining the maximum capacity course for each sensor node; and
- Routing accomplished and residual electricity up to date.

The MCP will iteratively carry out the above 3 steps for each round of message reporting.

Architecture Diagram

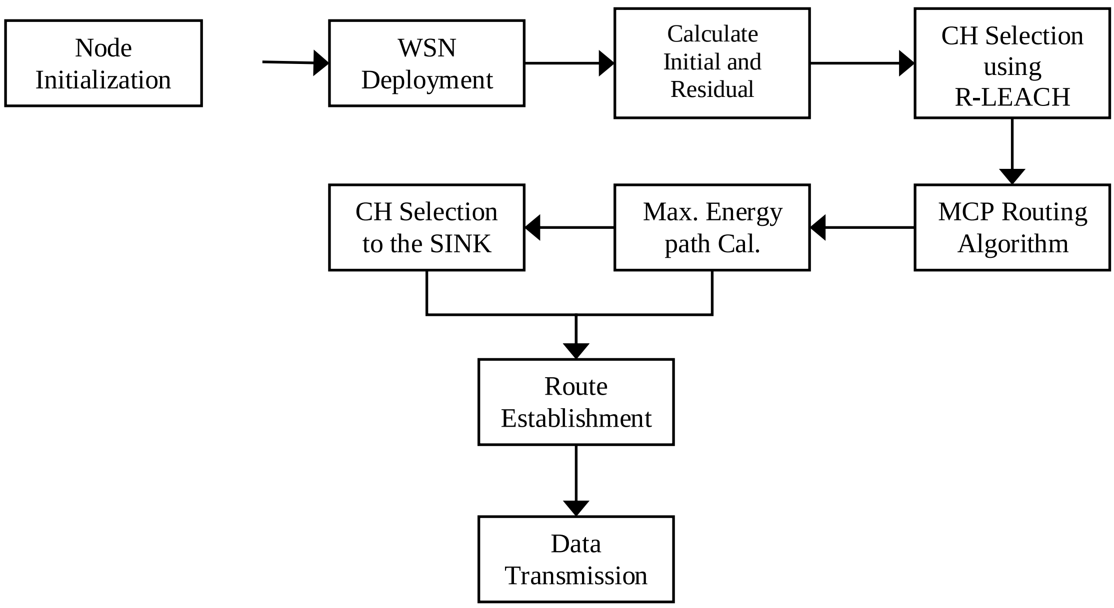


Fig. 1 MCP Routing method

WSN, energy saving is the key layout problem. Routing protocol designs of message reporting in a WSN can generally be categorized into two classes: static routing and dynamic routing. For the static routing type, when because the message reporting paths are decided, every sensor node will report its sensed information along the predetermined route to the sink at any time. On the alternative hand, a dynamic routing protocol would possibly modify the routing paths in every transmission round in keeping with the cutting-edge nation of the sensor nodes' residual battery electricity. Due to the truth that the dynamic routing protocols can stability the burden on every sensor node, it plays better for network lifetime prolonging than the static routing protocols.

B. EAR-MCP Techniques

In this proposed work, we use a dynamic routing protocol, called Maximum Capacity Path (MCP), as the underlying routing protocol of the proposed routing method. The MCP is proposed to perform well in prolonging network lifetime in a WSN. In the following, we will use an example to illustrate the procedure steps of the MCP routing algorithm.

A WSN and its current residual battery energy state of sensor node can be modelled by a capacity graph $G = (V, E)$, where set V denotes the collection of sensor nodes and E denotes all of the possible direct communication between sensor nodes. And let $r: V \rightarrow R^+$ be the residual battery energy function to represent each sensor's residual battery energy.

For example node s stands for the sink with infinity energy due to the fact that it can plug in to a power line or is equipped with an extremely large capacity battery compared to that of the sensor nodes. The value that is associated with node a is equal to 50, which stands for the current residual battery energy of sensor node a. The MCP mainly consists of three procedure steps. They are,Layering graph G into a layered network N; Determining the maximum capacity path for each sensor node; and Routing performed and residual energy updated. The MCP will iteratively perform the above three steps for each round of message reporting. Detailed operations for layering the graph in the first step are as follows. Let level number LV with respect to each sensor node $v \in V$ denotes the shortest path length from v to the sink s.For the example in Fig. (a), since the shortest path length from nodes g and h to node s are both 4, $Lg = Lh = 4$. The layered network N can be obtained from graph G by deleting the edges $(u,v) \in E$ such that $Lu = Lv$.For example, as shown in Fig. (a), since $La = Lb = 1$ and $Lg = Lh = 4$, then edges (a, b) and (g, h) will be deleted from G. Then the layered network N obtained from G is a directed graph, such that for all of the remaining edges $(u,v) \in E$ after the deleting operation, the directed edge (u,v) from node u to node v, if $Lu = Lv + 1$.

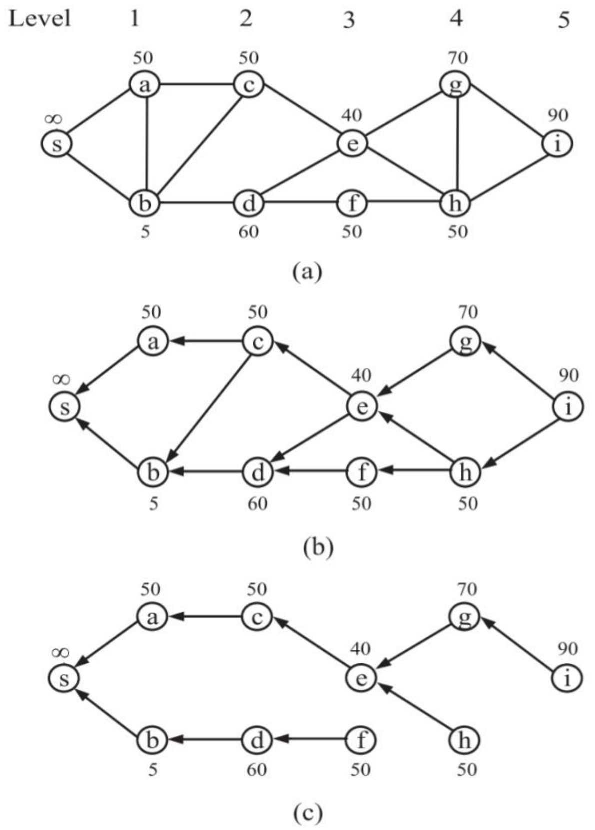
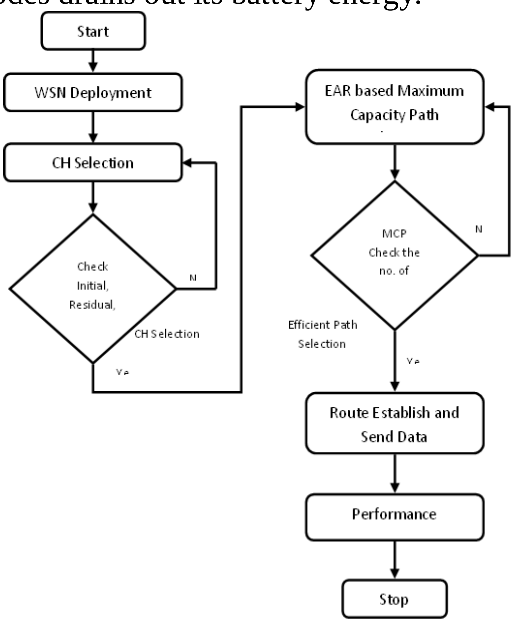


Fig. 2 MCP Working

Fig2. (b) shows the resulting network obtained from *G* in Fig. (a). Let *Pus* = *u*, *u1*, *u2*,..., *ul*,*s* be a path from node *u* to the sink *s* in *N*. And we let the capacity *c*(*Pus*) of path *Pus* be the minimum value of residual battery energy in path *Pus*; that is, *c*(*Pus*) = min{ *r*(*u*),*r*(*u1*),*r*(*u2*), . . . ,*r*(*ul*)}. Let *P*us* be the maximum capacity path with the maximum capacity value among every path from node *u* to *s*. The resulting graph of the union of each maximum capacity path *P*us*, $\forall u \in V$ will be the routing paths for message reportingFor example, Fig. (c) Shows the resulting maximum capacity paths obtained from the layered graph *N* of Fig. (b). and then the message will be relayed along the maximum capacity path *P*us*to *s*. For example, the maximum capacity path *P*gs*= *g*, *e*, *c*, *a*,*s*. After the message relaying from node *g* to s along path *P*gs*, the residual battery energy of each sensor node in the path is updated accordingly. The above three procedure steps will be repeated for each transmission round until one of the nodes drains out its battery energy.



Flow Chart of R Leach Protocol

V. RESULTS AND DISCUSSION

In this module, a wireless sensor network is created. All the nodes are configured and randomly deployed in the network area. Since our network is a wireless sensor network, nodes are assigned with initial energy, transmitting energy and receiving energy. A routing protocol is implemented in the network.Sender and receiver nodes are randomly selected and the communication is initiated.Initialize the wireless network nodes with multihop network by randomly deploying 30 nodes in an area of 1500 X 1500. Nodes are assigned with initial energy, transmitting energy and receiving energy. A routing protocol is implemented in the network. Sender and receiver nodes are randomly selected and the communication is initiated.

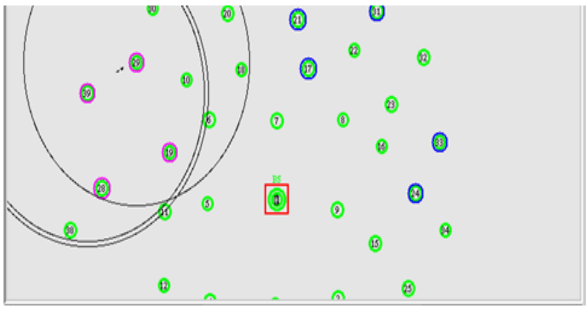


Fig. 3 (a) Network Deployment Scenario 1

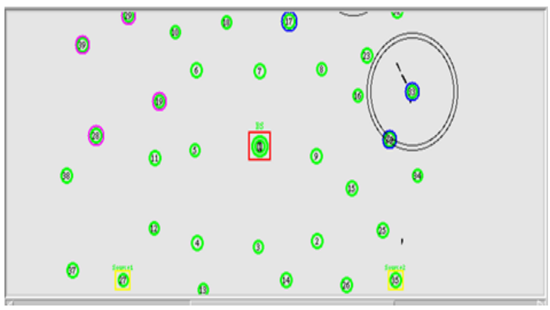


Fig. 3 (b) Network Deployment Scenario 2

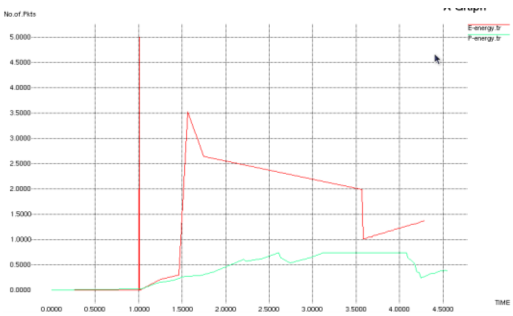


Figure.4 Energy vs. Time

The figure is showing the comparison graph to represent the amount of packets lost over the network. Here X Axis represents the number of nodes and the y axis represents the energy in the network. In case of proposed network, the predictive rules are implemented. The results shows that the conferred work offers the packet lost at the start, however because the algorithmic approach is enforced and therefore the route reconfiguration is finished, then no a lot of knowledge lost is there. Network Deployment All the nodes are configured to exchange the location and initial energy information among all the nodes. All the nodes are configured to exchange the location and initial energy information among all the nodes. A routing protocol is implemented in the network.Base Station is configured with highest communication range. As shown in Figure, the proposed TLS scheme generates lower normalized routing overhead than the MCP-based WSN and existing routing.

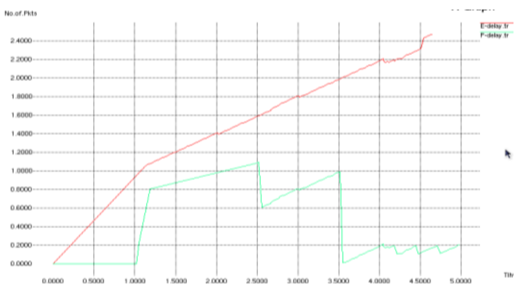


Figure.5 Delay vs. Time

The figure is showing the comparison graph to represent the number of packets delay over the network in Existing and Proposed Approach. Here X Axis represents the nodes and the y axis represents the number of packets delay in the network.

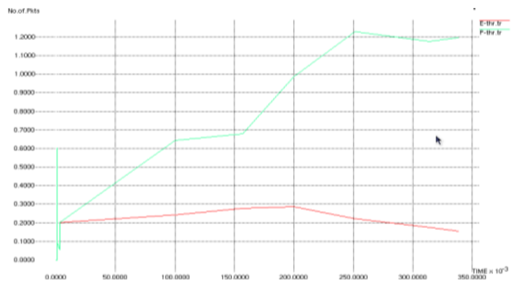


Figure 6 Throughputs vs. Time

Figure shows the response time for node `mobility events and is compared with the AODV-based UASN networks. This experiment considers the link failure issue for a single data flow and the influence of other background traffic is not considered here. The figure is representing the graph which analysis on last packet time over the network. Here X Axis represents the number of nodes and the y axis represents the last throughput. The results here shows that the in both kind of network the communication is performed on same rate but the difference is in terms of packet forwarding and rerouting of the network.

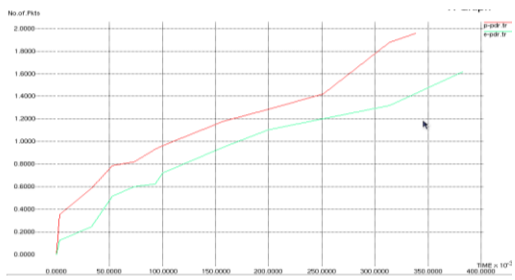


Figure 7 Delay vs. Nodes

As shown in Figure, the proposed TLS scheme generates lower normalized routing overhead than the DVOR-based USAN and AODV routing. The figure is showing the comparison graph to represent the number of packets delay over the network in Existing and Proposed Approach. Here X Axis represents the nodes and the y axis represents the number of packets delay in the network. The results shows that the packet delay in proposed work is reduced Data Transmission is established between nodes using UDP agent and CBR traffic. In this module, to enable all the nodes to get the global energy model, we propose a proposed algorithm, that under this general dynamic battery model, there exists an optimal policy consisting of time-invariant routing probabilities in a fixed topology network and these can be obtained by solving a set of problems. In this proposed work, we use a dynamic routing protocol, called Maximum Capacity Path (MCP). Exchange all node energy and location information. Determining the maximum capacity path for each sensor node; and Routing performed and residual energy updated. The MCP will iteratively perform the above three steps for each round of message reporting. In this module, the performance of the proposed network coding method is analysed. Based on the analysed results X-graphs are plotted. Throughput, delay, energy consumption are the basic parameters considered here and X-graphs are plotted for these parameters. Finally, the results obtained from this module is compared with previous results and comparison X-graphs are plotted. Form the comparison result, final RESULT is concluded.

B. Performance Metrics

Throughput:

It is the ratio of the total number of bits transmitted (Btx) to the time required for this transmission, i.e. the difference of data transmission end time and start time (tstart). This metric depicts how the congestion control mechanism at the source node is affected by the packet losses caused by JF-nodes. A decrease in throughput is an outcome of any JF attack.

Throughput = $(B_{tx})/(t_{end} - t_{start})$ bps

Packet Delivery Ratio:

This is defined as the ratio of the number of packets received at the destination and the number of packets sent by the source. Here, $pktd_i$ is the number of packets received by the destination node in the ith application, and $pkts_i$is the number of packets sent by the source node in the ith application.

Average End-to-End Delay:

It is average transmission delay of packets transmitted from source to destination. D is computed as the ratio of the sum of individual delay of each received data packet to the total number of data packets received. This metric is used to evaluate impact of a JF-attack on delay-sensitive applications of TCP-based MANETs. By intentionally discarding, delaying or reordering packets, a JF-node can increase the value of this metric; increase being caused by re-transmissions of such packets due to timeout at TCP source.

D= no. of received packed/total time

VI. CONCLUSION

Since energy and lifetime are fundamental constraints in designing any routing protocol for WSN, a lot studies has been carried out to acquire the aim. Choosing an electricity-green routing algorithm that distributes the load within the network lightly is a challenging method. LEACH protocol guarantees an adaptive set of rules but nevertheless has some obstacles. A modified CH choice set of rules has been advised in this paper that ambitions to extend the community lifetime by using controlling the strength dissipation in the network. The better routing procedure can be used effectively in scenarios like environmental monitoring the usage of IoT because the protocol supplies a better end result for homogeneous networks in comparison to LEACH. An energy-green routing set of rules that distribute the load inside the network calmly is a difficult process. Using the EAR-MCP protocol, more advantageous routing process can be used correctly in scenarios like environmental tracking using IoT. Simulation end result shows advanced community performance for metrics which includes residual electricity, packets sent to BS, throughput and lifelong.

VII. FUTURE WORK

As future work Phase II will be consider delay and EAR constrained WSN applications and design a routing protocol that can achieve the best trade-off between maximizing network lifetime in multi-hop networks.So In phase II will analyze the remaining work of EAR-RR protocol to improve the network lifetime and efficiency. Also the simulation output will compare the efficient phase II parameters with proposed work.

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