An Approach for Improved Virtual Gridding in WSN

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Abstract

WSNs encompass sensors, which are randomly dispersed in huge regions, collecting essential information from their surroundings. Sensor nodes have limited quantity of batteries. It is not likely to bring out standby sensors or renewing of sensors that are located in distant or challenging surroundings. Clustering of the nodes is the most commonly used approach to improve the lifespan of WSN. This paper proposes a virtual gridding based clustering approach, which takes, into account modified round robin schedule of the cluster heads for the cluster head rotation phase. The parameters used to analyze the performance of the network were remaining energy, throughput, packet delivery ratio and routing overhead. They have shown improvement over the existing scheme.

Keywords — *WSN, virtual gridding, PDR, throughput.*

I. INTRODUCTION

WSNs encompass sensors, which are randomly dispersed in huge regions, collecting essential information from their surroundings. [8] Sensor nodes have limited quantity of batteries; power-depleting processes similar to information collecting, broadcasts in addition to reception are to be as marginal as conceivable. Additionally, it is not likely to bring out standby sensors or renewing of nodes that are located in distant or perplexing surroundings. WSNs are to transmit the gathered info to sinks, generally located far from the network setting. Network lifespan thus is a noteworthy degree of networks' effectiveness. Network lifespan signifies the period from the formation to the period once networks turn out to be non-functioning (which is typically once node expires) [9].

The residual energy of the nodes determines the network lifetime [13]. Besides, it is enormously approved on that equilibrium of power consumption among the network sensors is important in the augmentation of network lifespan. Numerous difficulties in WSNs similar to node placement, localization, energy-responsive clustering in addition to information gathering is normally measured as optimization problems.

Clustering talk about the process of dividing dataset into subsections named clusters so that data in entire subsections shares definite mutual features. Investigation into clustering has been on for an extensive period. Sensor clustering procedures are normally simulated out in dual phases: sensor clustering formation along with preservation. In the previous, cluster heads are selected between the nodes. When head is selected, additional sensors connected with the heads start creating the groups. Sensors, which are not cluster heads, are identified as normal, associate sensors. When clustering is over, collected info is communicated to information sinks and this cuts needless plus redundant info transmissions. It too cuts the number of nodes, which are included in broadcasts and thus contribute in valuable power use. Eligible node send Advertisement packet to the cluster head. Nodes reply back with Join packet to the cluster head [14]. Cluster head aggregates the data from the members and usually forwards the data to base station using multi hop communication among the cluster heads. [10-12].

This paper proposes a virtual gridding based clustering approach which takes into account modified round robin schedule of the cluster heads for the CH rotation phase. The work aims to increase the performance of the network. Section II of the paper describes interrelated previous approaches. Section III explains the proposed approach with the results shown in the later part.

II. LITERATURE REVIEW

The authors in [1] suggested load balanced clustering procedure for sensor network, which can overcome preceding clustering procedures. In the preceding methods, the clustering of sensors is not stable and this can create the network energy disturbed. Based on their proximity and position, building it fundamentally dissimilar from the Suggested Location Based Clustering Procedure (LBC) can accomplish improved performance than present LEACH to form a cluster. In LBC procedure, the position of every existing sensor in the network is computed pertaining to X, Y-coordinates. This can support to circumvent arbitrary election of sensors in clusters. It augments the matching of the network and energy of network can be protected. Suggested Centre Point Detection Clustering Procedure (CPDC) decides the midpoint of the cluster and nearby sensor to that point with great energy nominated as Cluster Head (CH).

In this study [2], a routing procedure named Grid Clustering Hierarchy (GCH) that delivers an effective energy administration for sensor networks is suggested. This procedure splits the network into a flexible amount of simulated networks established on the present regular energy of the WSN to generate optimal clusters in relations to energy depletion. By means of a typical radio energy dissipation prototype that is ordinarily used for modelling of sensor networks, GCH is imitated and its performance is associated with LEACH.

The authors in [3] suggest and assess a fresh disseminated energy-efficient clustering procedure named DCE for varied WSNs, centred on a Double-phase Cluster-head Selection system. In DCE, the process of CH selection is separated into dual stages. In the primary stage, temporary CHs are chosen with the possibilities that are defined by the comparative stages of original and remaining energy. Now, in the subsequent stage, the temporary CHs are substituted by their fellows to create the concluding set of CHs if some fellow in their group has extra remaining energy. Using dual stages for CH selection guarantees the sensors with extra energy possess a greater probability to be CHs. Energy depletion is disseminated in the suggested procedure, and the experimental outcomes display that DCE attains extended stability phases than former usual clustering procedures in diverse situations.

In this study [4], the authors suggest an EEUCLC procedure that has a sub-optimum multi hop routing procedure to decrease the weight on the CH and a probability-centered CH election procedure to extend the network lifespan. Experimental outcomes display that the suggested method improved the energy equilibrium and extended the network lifespan linked to former associated procedures.

In this study [5], the authors are executing Clustering procedure in EEEMR algorithm. EEEMR Procedure is addition of AOMDV routing procedure with the Bio stimulated Cuckoo Search Algorithm. The EEEMR Procedure usages the remoteness trajectory notion and hop-by-hop transmitting method. The EEEMR Procedure likewise usages a RREQ advertised among source to destination and path finding procedure to discover the reactive paths. It correspondingly suggests in-between sensors with alternative routes, which are decreasing the path finding rate. The enlargement of cluster centered WSNs have lately revealed to decline the method delay, overhead and surge the network throughput and PDR. Experiment is accomplished by means of NS2 and an outcome demonstrates that the suggested method is improved than the present method. The suggested method energy depletion is diminished by 13% associated to the prevailing method.

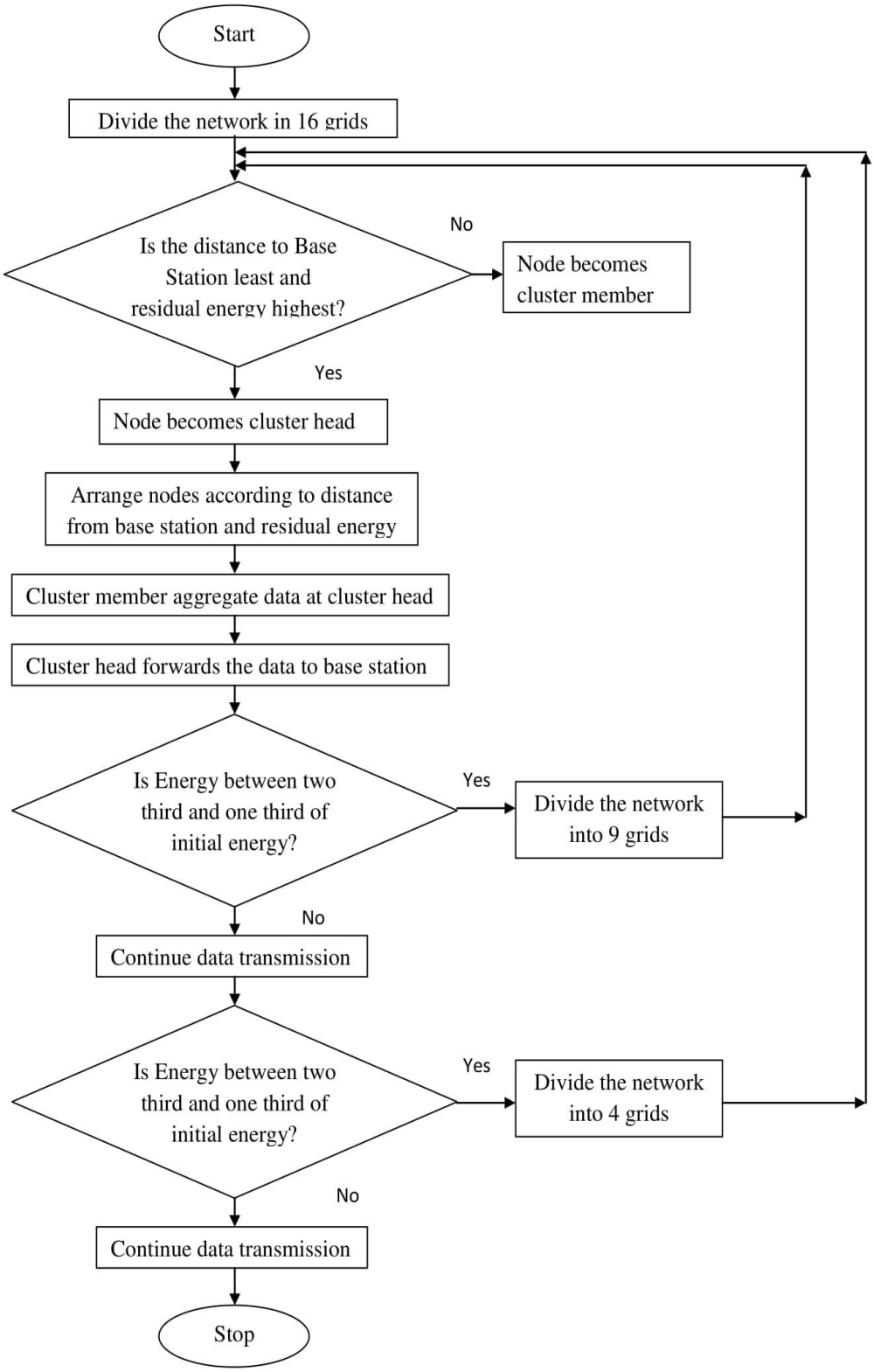
In this study [6], the authors have suggested a superior and enhanced form of WCA well-known as Energy Efficient Weighted Clustering Algorithm (EEWCA) to extend the network lifespan by decreasing energy depletion. EEWCA is planned and simulated with extra restriction on energy for the election of CHs. Both the WCA and EEWCA systems have been implemented by means of MATLAB. The suggested EEWCA performs superior than WCA for lengthier system lifespan.

This study [7] presents a new clustering procedure: Fuzzy Logic Based Energy Efficient Clustering Hierarchy (FLECH) for non-uniform sensor networks. The clusters in FLECH are generated by means of appropriate factors, which surges the lifespan of the sensor networks. Fuzzy logic in FLECH is sensibly used to associate imperative factors similar to remaining energy, node centrality, and proximity to BS for choosing finest appropriate sensors as CH and surges the network lifespan. FLECH performance is confirmed in dissimilar situations and the consequences are associated with LEACH, CHEF, ECPF, EAUCF, and MOFCA. The experimental outcomes undoubtedly show the lifespan surge by FLECH above former procedures and its energy preservation each round of information gathering in the network.

III. PROPOSED WORK

The proposed scheme aims at modifying the round robin schedule of the cluster heads by taking parameters of the nodes into account. Initially the base station will divide the entire network into 16 virtual grids, which will be considered as 16 clusters. In the proposed scheme, the residual energy of the nodes as well as distance from base station will be considered while making the round robin schedule for the nodes in a particular grid to form cluster heads. The node having least distance to the base station and highest residual energy will be considered as the first candidate to become cluster head.

Next step is the data transmission phase, where the nodes aggregate their data at the cluster heads, which finally relay their data to the base station. In the proposed scheme, the multi hop communication is preferred between the base station and the cluster heads. The proposed approach would divide the virtual girds from 9 from 16 (when remaining energy of the network is between $2/3^{rd}$ and $1/3^{rd}$), and to 4 from 9 (when remaining energy of the network is less than $1/3^{rd}$). This would consequently reduce the communication distance between the nodes and the Cluster thus improving the lifetime of the network heads. The process of data transmission will repeat in multi hop fashion.


Start
Divide the network in 16 grids
Is the distance to Base Station least and residual energy highest?
No
Node becomes cluster member
Yes
Node becomes cluster head
Arrange nodes according to distance from base station and residual energy
Cluster member aggregate data at cluster head
Cluster head forwards the data to base station
Is Energy between two third and one third of initial energy?
Yes
Divide the network into 9 grids
No
Continue data transmission
Is Energy between two third and one third of initial energy?
Yes
Divide the network into 4 grids
No
Continue data transmission
Stop

IV RESULTS AND DISCUSSION

The proposed scheme as well as the existing scheme was simulated in open source software, NS2.35. The simulation parameters that were considered in the study are described in the table below:

Table I: Simulation Parameters

Parameter	Type
Channel	Wireless
Propagation Model	Two Ray Ground
Mac	802.11
Queue	Drop Tail
Antenna	Omni Directional
Number of nodes	100
Initial Energy	40 Joules
Network Area	1200m * 1200m
Base Station location	600,600

The parameters used to analyse the performance of the network were remaining energy, throughput, packet delivery ratio and routing overhead. Their graphs obtained have been shown below:

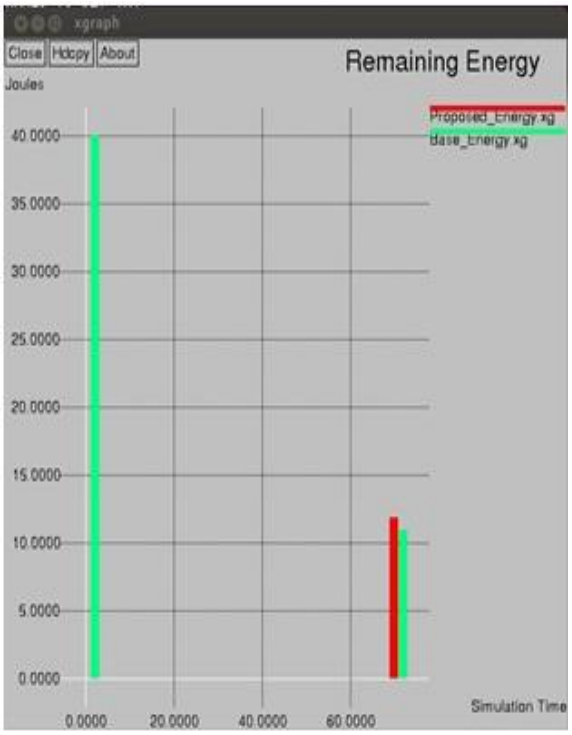


Fig 1: Remaining energy Comparison

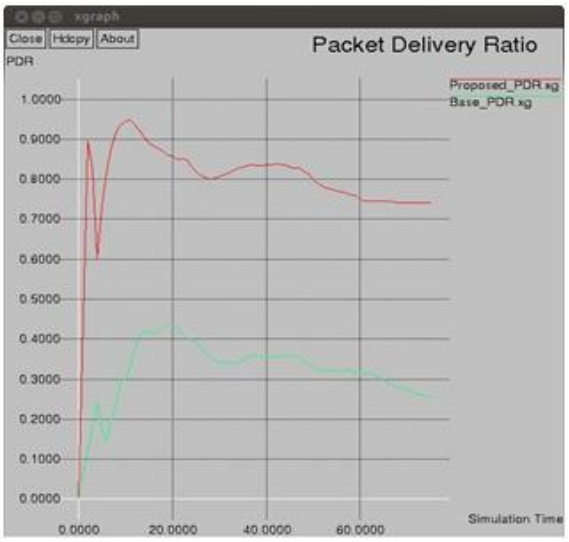


Fig 2: PDR Comparison

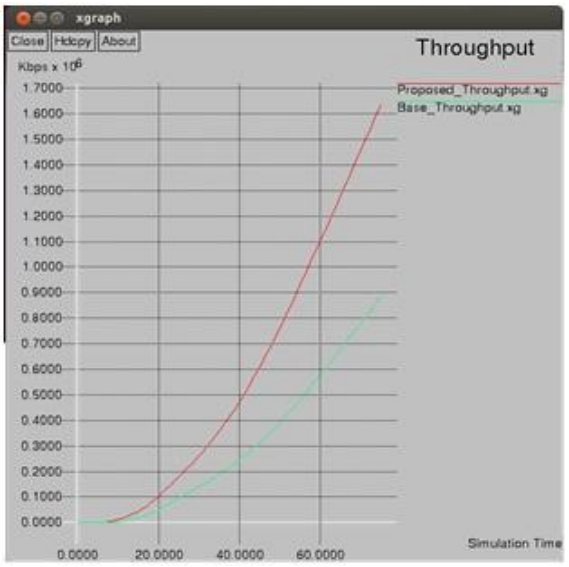


Fig 3: Throughput Comparison

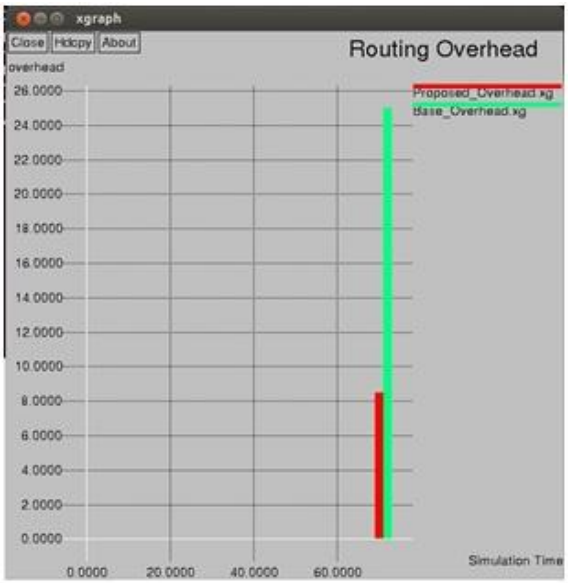


Fig 4: Routing Overhead Comparison

III.CONCLUSIONS

The performance of both the schemes was analysed based on remaining energy of the network, throughput, and packet delivery ratio and routing overhead. This increase in the parameters, namely PDR and throughput, is attributed to the fact that as the residual energy goes down, the number of virtual girds don't decrease as fast as in the existing scheme [2]. When the numbers of virtual grids are more, the distance of communication between the cluster members and their heads is less. And on the top of it, the multi hop communication among the CH and the BS further reduces the distance. Thus it can be fairly concluded that modified round robin schedule, the inclusion of multi hop communication and not reducing the virtual gridding to zero level has improved the performance of the network.

The other traditional clustering protocols don't use the process of reducing the number of clusters, so this scheme can be incorporated in those protocols in the future.

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