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Improved Multilevel Clustering Algorithm for Wireless Sensor Networks

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ABSTRACT

The wireless sensor networks are the decentralized and self configuring type of network in which sensor nodes can perceive information and move it to the base station. Because of decentralized environment and far deployment energy consumption is the major issues of wireless sensor networks. In this research work, WEMER protocol is implemented and improved to increase lifetime of wireless sensor networks. In the WEMER protocol, the whole network is broken into clusters and cluster heads are selected in each cluster. The leader nodes are also decided in the network which take data from the cluster heads and pass it to base station. In the improvement of WEMER protocol, we set up gateway nodes in network to increase lifetime of WSN. In deploy the proposed improvement gateway nodes near to base station which takes data from the leader nodes. The leader nodes take data from the cluster head. We implement the proposed WEMER protocol in MATLAB. The simulation results shows that proposed WEMER protocol has less number of dead nodes, high number of conscious nodes, send number of packets and more remaining energy utilization.

Keywords - *LEACH, WEMER, Cache, Energy Efficient,*

I. INTRODUCTION

We deploy the sensor nodes in the specified area to form the wireless sensor networks which can amass the information from the field and transfer it to the sink. The size of sensor node present in the network is extremely small. Thus, the handling capabilities it serves and the battery available in it is very constraint. According to the changes, the information is collected from the surroundings and then forwarded further by the network. This network has great computational and handling constraints. Motes are referred to as the small sized computers with the aid of which information is collected from all across the region. Motes are deployed today within various industrial applications. Using a group of motes, certain objectives within an application are achieved by collecting all the knowledge related to the activities being performed in the surroundings [1]. Depending on variety of configurations, it connects motes with each other through inks such that the best work results can be achieved. To perform communication amongst each other, transceivers are used by motes. The formation of sensor network within an application can build around hundreds to thousands of sensor nodes. However, there are comparatively less numbers of sensor

nodes present within the ad hoc networks which do not include any framework. There are several sensor nodes deployed in the territory of interest when a WSN is deployed. The sensor nodes are less costly, small in size and also perform multi-functioning. Even when the size of sensor nodes is small, the processing skills are performed [2]. Short distance communications are provided by the wireless channel and gather together nodes such that a common task can be accomplished. WSNs have few unique characteristics such that they are different from other networks. The sensors deployed within these networks make it possible to monitor or recognize the physical conditions in WSNs. These networks have more benefits compared to the conventional wired networks. It is not possible to reduce all the costs and delays occurring within these networks. The deployment of WSNs is done within several regions ranging from military applications to other small range of applications as well [3]. Since the sensor nodes involved within these networks are very less costly and they provide ease of communication, WSNs can be easily deployed within several applications such as in military and civil regions. The WSNs consist of un-attended and un-tethered sensor nodes within them which help in monitoring the surroundings. Within the area of interest, the distribution of these sensor nodes is done and multi-hops are used to transfer such information further. With the help of such deployments, an ad hoc network is created in this manner. The sensor nodes include within them the battery powers which are small in size and irreplaceable or rechargeable. The nodes collect relevant information which is transformed and stored within the sink node or the gateway node which is usually one within the region. An important component of sensor nodes is battery which helps in performing data acquisition [4]. It is however, not possible to recharge these batteries. The batteries include few energy generating units which are known as photo-voltaic cells within them, because of the node acquisition the energy of order 1 to 2 J is provided as there are tiny sized sensors nodes present in the networks. Thus, there is limited lifetime of a sensor and because of this; the overall performance of network also gets affected. It is very different to perform routing within WSNs as compared to the conventional routing that is performed in fixed networks [5]. As the network does not include any infrastructure, the wireless links provided are unreliable. The routing protocols provide node failures here due to which it is important to save energy in the networks. Several analysts have proposed various routing protocols which have been classified into various categories. The location-based protocols focus on the information related to the site location of sensor nodes. The site location of sensor nodes is vital to be known by most of the routing protocols so we can measure such that the distance amongst two particular nodes. This mechanism also works in determining an estimate of amount of energy that is being consumed by the networks. These types of routing protocols are very different from others as from source to the sink the data is transmitted here. Each source sends the data to the sink in an independent form such that these address-centric protocols can process it [6]. We aggregate the data that originates from multiple source sensors using the data-centric protocols when the transmission is to be performed amongst the source and sink of the network. The amount of energy being saved here is higher as very less amount of transmission from source to sink is needed here. Different researchers have proposed several viewpoints based on which hierarchical clustering in WSN has been tested and developed. Clustering is the effective communication protocol used to

transmit the sensed data towards sink. This research presents a view over the sample of layered protocols involved within different clusters of sensors. Each cluster includes within it a special node identified as cluster head. There are few special tasks performed by this cluster head for other nodes of the cluster.

II. LITERATURE REVIEW

Ramin Yarinezhada, et.al (2018) showed the relation shared between the sensor nodes and sink node as it forwarded the more traffic loads in the wireless sensor network. To forward the data ahead, it is very necessary to have knowledge regarding the position of mobile sink [7]. It is possible that the energy being consumed and the delay of network are higher when the sink's position is clearly provided. A new routing algorithm is proposed here depending upon the virtual grid infrastructure as well as the mobile sink. This novel approach also helps in choosing the nodes that are applicable from the network. It is also ensured that the sink's location is made static. They performed experiments and concluded results illustrate the efficiency of the proposed method in terms of performance, energy efficient and compared delay as compared to the other methods.

Ram Murthy Garimella, et.al (2018) suggested the wireless sensor network in this paper, in which essential act is played by the energy performance. A novel mechanism is proposed here such that any kind of investigation gaps described previously can be overcome. In order to apply the energy efficient approaches such that the data can be collected and routing can be performed is done using the Hessian matrix [8]. The novel approach includes within it the multi-variable calculus which can be validated by applying the suggested technique. Several simulations were performed by using this proposed technique. They utilized the mathematical design to be applied in the clustering technique. It was seen through the results attained, that the minimum energy communication design was achieved at the end.

Deepa PUNEETH, et.al (2018) analyzed the study related to some parameters that plays an essential role in the functionality of the wireless sensor network. In order to obtain the energy efficiency and data reliability, a different approach is recommended [9]. The compromised node (CN) attack is the limitations of these approaches which occur when there are minimum numbers of nodes are compromised. Therefore, to overwhelm all the above mentioned issues, they suggested another method in this paper using which security against CN attacks is provided. It also provided the data reliability, efficient energy in the network. The split hop AES (SHAES) defined the assimilation of SRSS and a round-reduced AES cipher which was there main objective. In case when the CN attack is to be validated, this approach is applied such that it can be evaluated in a better way. After achieving the results, comparisons were made which clearly revealed the improvement of results.

Peijun Zhong, et.al, (2018) studied that rise in demand of WSNs is because of the tremendous development and developing technology, it has been utilized it different fields. They discussed the hot spot problem as the base station is closer to nodes of the network which tend to die earlier than other sensors. Therefore, they introduced the theory of mobile sink node, in order to remove this issue effectively [10]. The nodes of the hot spot can be distributed evenly in all directions as the sink node can move along certain trajectories. In detailed, they studied the energy capable routing method in which

multiple mobile sinks was used. In the several clusters the whole network was split in order to perform various experiments to show the effects of mobile sink on the network lifetime.

Hassan Oudani, et.al (2017) presented the study related to the wireless sensor network and faced issues in this paper in which utilization of more energy points to decease in the network lifetime. They developed some hierarchical protocols that lead to reduce in the network traffic toward the sink and also enhance the handling capability of network. They used the hierarchical cluster-based approach named as LEACHES in order to observe the survey on the energy-efficient [11]. To minimize the issue of energy consumption and maximize the lifetime of network sensor, they proposed a new method in this paper. The novel approach designed in this paper is simulated here in MATLAB simulator. The experiments also evaluate the LEACH protocol to test its performance.

Nukhet Sazak, et.al (2017) presented the network in which sensor nodes are deployed randomly within the network where they can join and leave the network any time due to which significant design issues faced. There are some additional limitations faced by this network such as resource constraints, remote location, limited energy are the reasons due to which functionality of the network is degraded [12]. A novel approach commonly known as ANDM is designed here using which there is improvement in the energy efficiency. The integrated the ANDM with ETDMA and compared this combination with E-TDMA. The obtained results concluded the effectiveness of the proposed method which brings the usage up to 31 % approx. for the optimal energy.

III. Research Methodology

Wireless sensor network is the self-configuring and sensor nodes are small due to which the energy consumption is the major issue. LEACH is the efficient protocol which can improve a lifetime of the wireless sensor networks. LEACH works on the concept of clustering which can select the cluster head in each cluster based on distance and energy. This research activity is also based on the LEACH protocol. The protocol proposed in this analysis has the 3level hierarchy. In this hierarchy the cluster head, leader nodes and gateway nodes are involved for the data aggregation. Following are the 3-phases involved in the aggregation process:

Phase 1: Selection of the Cluster head

In this phase, the network is partitioned into certain clusters and process of cluster head selection is initiated by the base station. The information is passed all across the network, which states that an efficient cluster head can be chosen. The distance of one node from the base station is determined mathematically. The sensor nodes also present their residual energy which play significant role in being chosen as cluster head. The radius of each cluster is calculated and the sensor nodes which exist within the radius of the cluster suggest that cluster. The number of nodes shows the cluster should be 3 or more than 3. The nodes which are within the cluster should choose their cluster head on the basis of residual energy.

Phase 2: Selection of the Leader Nodes

In the Phase 1, the cluster heads are selected in the network to amass the data to the base station. Some nodes have least distance to the base station but do not have maximum residual energy. Those nodes have the chance to be selected as leader

nodes. The nodes which are not taken as cluster head are the volunteer nodes to be chosen as leader nodes. The calculation is performed in the network which represents maximum number of leader nodes in the network and the leader nodes will generate an arbitrary number between 0 and 1 and nodes which satisfy the defined condition are selection as leader nodes.

Phase 3: Selection of the Gateway node

The gateway selection is the last phase of proposed protocol. Gateway nodes are the extra nodes which are set up in the network to boost network lifetime. The number of gateway nodes depends upon the magnitude of network. The cluster heads transmit the data to leader nodes. The leader nodes transmit data to gateway nodes. The gateway node forwards this data to the base station. The base station takes data from the nearest gateway node and leader node transmits the data to the nearest gateway node. The distance between the nodes is calculated with the Euclidean distance.

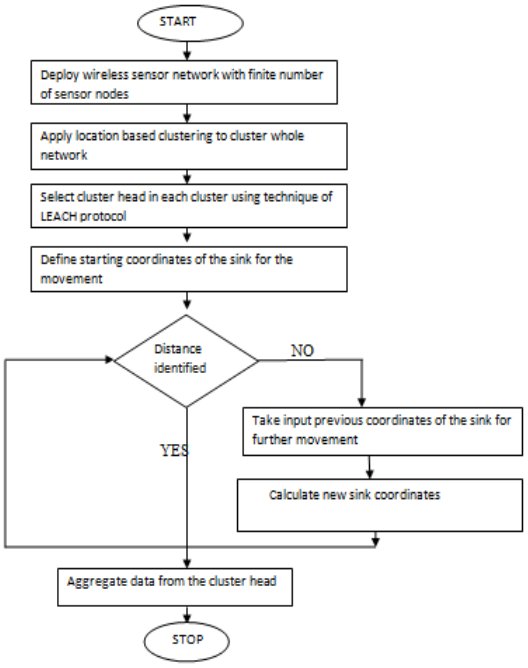

Figure 1: Proposed Flow Chart

Description of Flowchart

The finite number of sensor nodes are set up in The wireless sensor network and using location based clustering approach set up network is divided into clusters of fixed size.

With the technique of LEACH protocol for each cluster, cluster head will be chosen having maximum energy level and minimal distance from remaining node in the cluster. Aggregated data of other node will be available at cluster head

For sink movement; initial population taken as sink coordinates. signal strength check by the sink on the basis of initial population and aggregated data from where it get utmost data

For required data to get aggregated at base station repeat step 3

Proposed Algorithm

Input: Sensor nodes

Output: Efficient data aggregation

Begin

1. Deploy network with finite number of sensor nodes
2. Divide whole network into fixed size clusters based on location based clustering
3. Select cluster head

if (energy of sensor node(i)> energy of sensor node(i+1)

If (distance of sensor node(i)< distance of sensor node(i+1)

Select sensor node(i) as cluster head

4. Check the coordinate of the mobile sink

If (data aggregation at location (i)> data aggregation at location (i+1)

Move sink to location i

5. Cluster head aggregate data to sink at location i

IV. EXPERIMENTAL RESULTS

The proposed work is implemented in MATLAB and the results are evaluated by making certain comparisons as shown below.

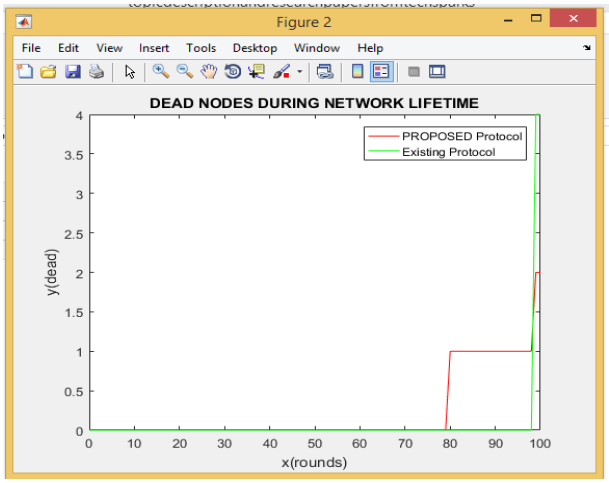

Figure 2: Number of dead nodes

Figure 2 represent that, the number of dead nodes in the proposed and existing algorithm is compared. It is analyzed that number of dead nodes in proposed work is four and in the existing algorithm it is two.

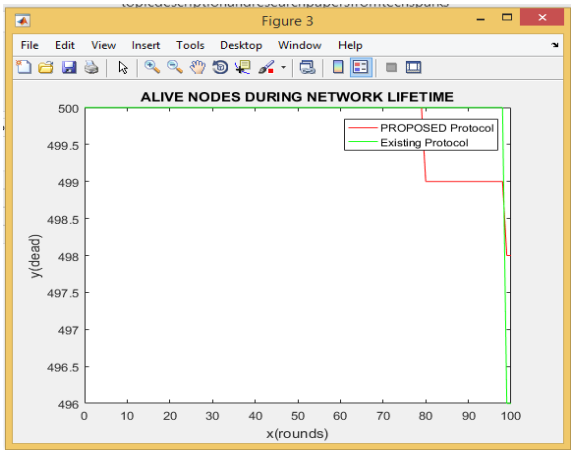

Figure 3: Number of alive nodes

Figure 3 demonstrate that, the number of alive nodes in the existing scheme is compared with the proposed scheme. It is observed that number of alive nodes is more in the proposed scheme as compared to existing scheme

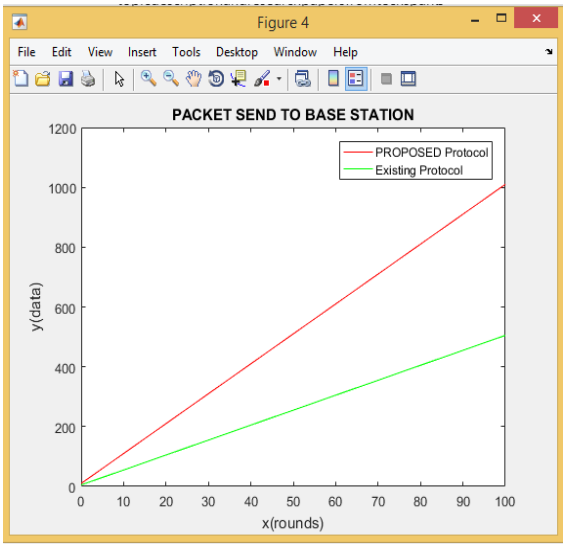

Figure 4: Number of packets transmitted

Figure 4 shows that, the number of packet transmitted in the proposed technique is compared with the existing technique. It is analyzed that number of packets which are transmitted in the proposed technique is more as compared to existing technique.

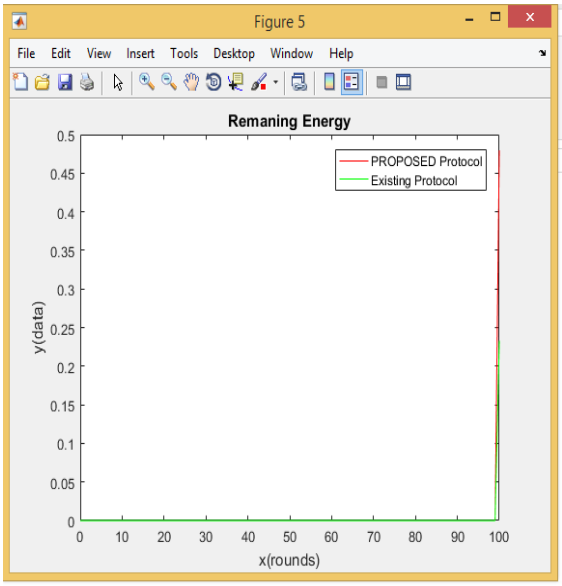

Figure 5: Remaining Energy

Figure 5 shows that, the remaining energy of proposed technique is compared with the existing technique. It is analyzed that remaining energy in proposed technique is more as compared to existing technique.

V. CONCLUSION

The sensor nodes are used to set up the wireless sensor network which is the decentralized type of network. The energy consumption is the main challenge of the wireless sensor network due to its far deployment. The 2-level hierarchical routing protocol is proposed previously to improve lifetime of WSNs. In the 2-level hierarchical routing protocol, the cluster heads and leader nodes play important role for data aggregation. In this research work, improves the WEMER protocol using the gateway nodes. The cluster head deliver information to leader node which transmitted information to leader node. The leader node then transmitted information to gateway node. The proposed protocol is implemented in MATLAB and simulations projects up to 20 percent gain in the results.

REFERENCES:

[1] Sanjeev Saini, Ram Sewak Singh & V. K. Gupta," Analysis of Energy Efficient Routing Protocols in Wireless Sensor Networks, International Journal of Computer Science & Communication, Vol. 1, No. 1, pp. 113-118, June 2010.

[2] W. Heinzelman, A. Chandrakasan and H. Balakrishnan, "Energy- Efficient Communication Protocol for Wireless Microsensor Networks," Proceedings of the 33rd Hawaii International Conference on System Sciences (HICSS '00), January 2000.

[3] Rajni Meelu & Rohit Anand, "Performance Evaluation of Cluster-based Routing Protocols used in Heterogeneous Wireless Sensor Networks", International Journal of Information Technology and Knowledge Management, Vol. 4, pp. 227-231.

[4] Shio Kumar Singh, M P Singh, and D K Singh, "Routing Protocols in Wireless Sensor Networks –A Survey", International Journal of Computer Science & Engineering Survey (IJCSES), vol.1, Issue 2, November 2010.

[5] Ming Liu, Jiannong Cao, Guihai Chen and Xiaomin Wang," An Energy-Aware Routing Protocol in Wireless Sensor Networks, in International Journal of Sensors, vol. 9, pp. 445-462, 2009.

[6] Djallel Eddine Boubiche and Azeddine Bilami, "HEEP (Hybrid Energy Efficiency Protocol) based on chain clustering", International Journal on Sensor Networks, vol. 10, 2010.

[7] Ramin Yarinezhada, Amir Sarabi, "Reducing delay and energy consumption in wireless sensor networks by making virtual grid infrastructure and using mobile sink", 2018, Int. J.Electron. Commun. (AEÜ) 84, 144–152

[8] Ram Murthy Garimella, Damodar Reddy Edla, Venkatanareshbabu Kuppili, "Energy Efficient Design of Wireless Sensor Network: Clustering", IEEE, 2018

[9] Deepa Puneeth, Nishanth Joshi, Pradeep Kumar Atrey, "Energy-efficient and reliable data collection in wireless sensor networks", Turkish Journal of Electrical Engineering & Computer Sciences, 2018

[10] Peijun Zhong and Feng Ruan, "An energy efficient multiple mobile sinks based routing algorithm for wireless sensor networks", IOP Conference Series: Materials Science and Engineering, 2018

[11] Hassan Oudani, Salahddine Krit, Mustapha Kabrane, Kaoutar Bandaoud, Mohamed Elaskri, Khaoula Karimi, Hicham Elbousty, Lahoucine Elmaimouni, "Energy Efficient in Wireless Sensor Networks Using Cluster-Based Approach Routing", International Journal of Sensors and Sensor Networks 2017

[12] Nukhet Sazak, Ismail Erturk, Etem Koklukaya, Murat Cakiroglu, "Impact of Active Node Determination Approach for Energy Efficiency in WSN MAC Protocol Design", IEEE, 2017

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