A Survey- Multi Gateway Nodes in Wireless Sensor Network

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Abstract **- In wireless sensor network number of sensor nodes are deployed in an area and the key concern is to enhance the network lifetime and to minimize the energy consumption of the network by using some energy efficient techniques. To enhance the network lifetime there are many protocols Like LEACH, M-GEAR. This paper defines the overview of some energy efficient protocols (M-GEAR), The gateway-based energy-efficient routing protocol (M-GEAR) for Wireless Sensor Networks (WSNs) divides the network sensor nodes into four logical regions on the basis of their location in the sensing field. This paper will give brief idea about M-GEAR.**

Index Terms **- Wireless Sensor Network, Sensor nodes, LEACH, M-GEAR, Gateway Protocol, TDMA.**

I.INTRODUCTION

The wireless sensor network consists of hundreds to thousands tiny devices called sensor nodes deployed in a particular network area, the sensor nodes are multi-functional nodes with low power, which work in an unattended environment and ability of sense, computation, and communication. The basic components of a sensor node are a sensor unit, an ADC (Analog to Digital Converter), a CPU (Central Processing Unit), a power unit and a communication unit [1][5]. Sensors nodes are of very small size, use extremely low energy, are operated in high volume density area and are independent and adaptive to the environment. The use of sensor node in a wireless sensor networks faces the problem of energy constraints as it has limited battery lifetime. For its activities, each node depends on energy which has become a major issue in wireless sensor networks. The failure of one node in a network can affect the entire system or application. Every sensing node can be in active, idle and sleep modes [5][8]. In active mode, nodes consume energy when receiving or transmitting data. In idle mode, the nodes consume almost the same amount of energy as in active mode. While in sleep mode, the nodes shutdown the radio to save the energy. This effects the network lifetime and stability of the network. To enhance the network lifetime there are many protocols on of them is advise gateway-based energy-efficient routing protocol (M-GEAR). The gateway-based energy-efficient routing protocol (M-GEAR) for Wireless Sensor Networks (WSNs) divides the sensor nodes into four logical regions on the basis of their location in the sensing field [1][2]. This paper gives the review study of M-GEAR.

II. M-GEAR MODEL

The gateway-based energy-efficient routing protocol(M-GEAR) mainly try to maximize the life of the WSN by developing some optimal shortest routing paths and by minimizing the data travelling distance among the nodes [1]. There are some other issues that will affect the WSN working, these can be like switching off the radio components of the nodes whenever they are not in use and nodes should have to self-organize to maximize the energy efficiency. It becomes more essential to take necessary action to develop the new routing algorithms. The main objective of routing technique is not only to make communication among source station and destination but to perform this function in energy efficient way so that network does not affect. Architecture and design of the network also affects the energy of the sensor nodes. Q. Nadeem, M. B. Rasheed et al [1], In this research paper, it focused on gateway-based energy-efficient routing protocol (M-GEAR) for Wireless Sensor Networks (WSNs) and divide the sensor nodes into four logical regions on the basis of their location

in the sensing field. install Base Station (BS) out of the sensing area and a gateway node at the center of the sensing area. If the distance of a sensor node from BS or gateway is less than predefined distance threshold, the node uses direct communication then divide the rest of nodes into two equal regions whose distance is beyond the threshold distance. then select cluster heads (CHs)in each region which are independent of the other region. These CHs are selected on the basis of a probability. The network model used in this paper are divided into phases [1][2]

a. Initial Phase: The sensor nodes are dispersed randomly in homogeneous network area and the location of BS; sensor nodes is calculated with distance of each node and save all information of the sensor nodes into the node data table.
b. Setup Phase: in this phase the network is divided into regions based on the location of the nodes and BS divides the nodes into four regions.
c. CH Selection: CHs are elected in each region separately based on the probability. Let ri represent the number of rounds to be a CH for the node S i . Each node elect itself as a CH once every r i = 1/p rounds.
d. Scheduling: When all the sensor nodes are structured into clusters, each CH creates TDMA based time slots for its member nodes. All the associated nodes transmit their sensed data to CH in its own scheduled time slot. Otherwise, nodes switch to idle mode.
e. Steady-State Phase: then all sensor nodes transmit their sensed data to CH. The CH collects data from their member nodes, aggregates, and forwards to gateway node. Gateway node receives data from CHs, aggregates, and forwards to BS [1].

Sensing, processing, and data communication are the main activities of a sensor node, which causes energy depletion. Data communication accounts for consuming Residual Energy Monitoring in Wireless Sensor Networks most of the energy stored in the battery, but the energy consumed in sensing and processing cannot be neglected as well. Sensor nodes are powered by the energy accumulated in their batteries. Sensor nodes batteries can be either renewable or nonrenewable. Some sensor nodes use energy harvesting mechanisms to produce energy from thermal, solar and vibrations. Energy harvesting adds some complexity to the design of sensor nodes, since complex circuitries are used to generate energy [6][8]. Sensor nodes use various techniques to conserve energy. Some examples of the power saving methods are:

1. Dynamic power management (DPM)
2. Dynamic voltage scaling (DVS)
3. Dynamic frequency scaling (DFS)

A sensor node using DPM tries to minimize its energy consumption by switching off its components as much as possible. Components can be turned off randomly or following a predefined schedule. The disadvantage of DPM is that, turning on and off sensor nodes components consume a considerable amount of energy. DVS is a mechanism by which a sensor node varies the input voltage level to its components. This result in reduced power consumption at times the components of the node are idle. In DFS, power conservation is accomplished by varying the working frequency of the processor. Since processor power consumption and frequency have a direct relationship, as the frequency increases the power consumed by the processor also increases and vies versa. Using low frequencies results in slow processing of data in the processor. Location based Routing protocols Sensor nodes can also route data depend on their neighbor's location or relative position. The location of sensor nodes can be found either directly using on board GPS equipment or using methods such as triangulation [7]. The distance between two neighbors can be estimated with their signal strengths. Sensor nodes using location-based routing protocols forward data to nearby nodes. GAF, Geographic Adaptive Fidelity: This protocol divides the network into multiple square grids. Sensor nodes located in a similar grid are assumed to have the same energy cost [11]. This protocol tries to reduce energy consumption in the network by partially turning off the nodes in similar grid. To balance the energy depletion of nodes, they switch their state from active to sleep and vice versa. Even though it was originally designed for mobile networks, it can be used for stationary networks as well. ˆ GEAR, Geographical and energy-Aware Routing: GEAR is a query-based protocol, it uses geographical information to disseminate query in the network. Every node in the network maintains an estimated cost of transmission to its neighbors. The transmission cost calculation is based on residual energy of the node and the distance from its neighbors. Packet forwarding to the destination node is

accomplished in two phases: transmitting the packet to the destination region and transmitting the packet to the destination node within the region.

III. TIME DIVISION MULTIPLE ACCESS (TDMA)

In WSN the data transmission is done using TDMA. The features of TDMA include the following [6].

- With several users, The TDMA shares a single carrier frequency where each user's time slots with non-overlapping.
- In TDMA the data transmission is not continuous but occurs in bursts.
- For transmission TDMA uses different time slots and reception thus duplexers are not required.
- The different numbers of time slots per frame are allocated to different users.

As Wireless Sensor Network (WSN) consists of a huge number of spatially distributed autonomous sensors to monitor certain environmental and physical phenomenon and cooperate with each other to perform some task which is designated and send the collected information to the Base Station (BS). For enabling efficient network operation and achieving good performance in a network a MAC protocol plays an important role. As in most wireless sensor networks, collision, which is caused due to data sending between two nodes at the same time over the same transmission medium, this is a great concern in WSNs. To solve this problem, a sensor network must employ a MAC protocol which arbitrate to access the shared medium in order to avoid collision between data and at the same time is efficient to share the bandwidth resources among multiple sensor nodes. In TDMA based MAC protocols, time slots are divided into timeframes and each timeframe is further divided into a fixed number of timeslots as shown in Figure 1[1][6].

Each node in a network is allocated a timeslot in a timeframe and which is then allowed to transmit only in the allocated timeslot. Furthermore, a node which depends upon the scheduling of its neighboring nodes may remain in the sleep mode when it does not perform transmit or receive of data, i.e., can switch off their transceiver conserving appreciable amount of energy.

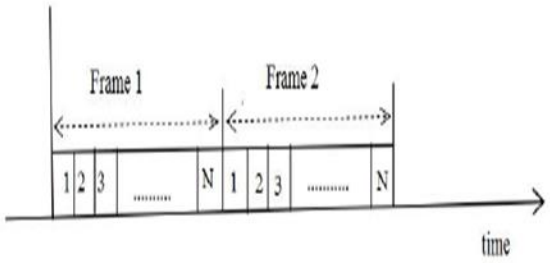

Figure 1 TDMA frame Structure[6]

IV. LITERATURE SURVEY

M. B. Rasheed et al[1], They focused on gateway based energy-efficient routing protocol (M-GEAR) for Wireless Sensor Networks (WSNs) and divide the sensor nodes into four logical regions on the basis of their location in the sensing field[1]. install Base Station (BS) out of the sensing area and a gateway node at the centre of the sensing area. If the distance of a sensor node from the BS or gateway is less as compare to predefined distance threshold, the node uses a direct communication then divide the rest of nodes into two equal regions whose distance is beyond the threshold distance, then select cluster heads (CHs)in each region which are independent of the other region. These CHs are selected on the basis of a probability.

Nazia anjum, Maood ahmed et al [2], This paper presented a gateway-based routing protocol name GEER which shows improved results a compared LEACH (Low Energy Adaptive Cluster Head) protocol. It has demonstrated significant change as far as system lifetime and energy efficiency when contrasted with different strategies and conventions being utilized as a part of Wireless Sensor Networks having settled power sensor hubs [2]. In this examination work, a novel calculation which takes legacy from door-based convention has been utilized as a part of which separated from the base station, an extra entryway hub is available. Further, the system range is sensibly partitioned into a few zones, on the premise of their relative situating from the passage hub.

Amandeep Kaur, Sukhbeer Singh, Neelam Chouhan [4] this work focus on distance based cluster head selection in M_GEAR and the communication among region nodes with the base station depends upon the positive coordinates of the region following the base station [4]. The distance based on cluster head

selection in defined region 2 and region 3 shows some improvement the andimproves performance of the network technique. It also minimizes the energy consumption during each round and improves the lifetime of the network.

Lujuan Ma et al, et al [6], This work presented a TDMA-based MAC protocols, which is used as a solution for communication in WSN. Which divides the whole-time span into small timeslots and allocate the slots to different nodes in a WSN. The nodes can use the allocated timeslots for data transfer whenever required. Nodes in the wireless sensor network can conserve more energy by entering into inactive states when they are not transmitting or receiving, this is avoided by TDMA. This paper gives a description of several TDMA-based MAC protocols both centralized and distributed for the wireless sensor network as defined above.

In gateway-based energy-efficient routing protocol (M-GEAR) for Wireless Sensor Networks (WSNs), If the distance of a sensor node from BS or gateway is less than predefined distance threshold, the node uses direct communication. Then divide the rest of nodes into two equal regions whose distance is beyond the threshold distance and the selection of cluster heads (CHs)in each region which are independent of the other region. In such cases for huge area only single gateway node is used, in which packet flood occurred. Which losses the data packets, so we will use the Enhanced gateway-based energy-efficient technique which works on the basis of multi gate way nodes, which helps to reduce the data loss and help to enhance the lifetime with better energy utilization of sensor nodes.

V. CONCLUSION

The paper gives survey on M-GEAR protocol, which is used for increasing the performance of the network by minimizing the energy consumption and increasing the throughput. The distance and the gateway node will affect direct communication by reducing the packet flood in the network. The TDMA protocol will also help to improve network lifetime, which arbitrate to access the shared medium in order to avoid collision between data and at the same time is efficient to share the bandwidth resources among multiple sensor nodes.

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The above contents and survey we mentioned is true to my knowledge.

REFERENCES

[1] Q. Nadeem1, M. B. Rasheed1 et al, “M-GEAR: Gateway-Based Energy-Aware Multi-Hop Routing Protocol for WSNs”, ieee july 2016.

[2] Nazia anjum, Maood ahmed et al,” Gateway Based Energy Efficient Routing: GEER”, International Journal of Advance Research, Ideas and Innovations in Technology, ISSN: 2454-132X, 2017.

[3] Velanati Mohana Gandhi1, M.V.H.Bhaskara Murthy2,M.Lakshmu Naidu3, “ Performance Analysis of Multihop-Gateway Energy Aware Routing (M-Gear) Protocol for Wireless Sensor Networks”, IOSR Journal Of Humanities And Social Science (IOSR-JHSS) Volume 21, Issue11, Ver. 9 ,PP 01-07, Nov. 2016.

[4] Amandeep Kaur, Sukhbeer Singh, Neelam Chouhan, “The Enhanced M-GEAR Protocol for Wireless Sensor Network LifeTime’, International Journal of Computer Sciences and Engineering, Vol.-7, Issue-6, June 2019.

[5] Aslam, M., Nadeem Javaid, A. Rahim, U. Nazir, Ayesha Bibi, and Z. A. Khan. "Survey of extended LEACH-Based clustering routing protocols for wireless sensor networks."In High Performance Computing and Communication & 2012 IEEE 9th International Conference on Embedded Software and Systems (HPCC-ICESS), 2012 IEEE 14th International Conference on, pp. 1232-1238. IEEE, 2012.

[6] Lujuan Ma 1, Henry Leung 2, and Deshi Li 3, “Hybrid TDMA/CDMA MAC Protocol for Wireless Sensor Networks”, JOURNAL OF NETWORKS, VOL. 9, NO. 10, OCTOBER 2014.

[7] S. Rani and S.H. Ahmed, Multi-hop Routing in Wireless Sensor Networks, Springer Briefs in Electrical and Computer Engineering, DOI 10.1007/978-981-287-730-7_2

[8] Jung, W. S., Lim, K. W., Ko, Y. B., & Park, S. J. “A hybrid approach for clustering-based data aggregation in wireless sensor networks”, In Digital Society, ICDS'09. IEEE, Third International Conference on (pp. 112-117), 2009.

[9] Maraiya, Kiran, Kamal Kant, and Nitin Gupta. "Wireless sensor network: a review on data

aggregation." International Journal of Scientific & Engineering Research 2.4 2011.

[10] Raju, G. T., D. K. Ghosh, T. Satish Kumar, S. Kavyashree, and V. Nagaveni. "Wireless sensor network lifetime optimization." 244-248, 2011.

[11] Jung, W. S., Lim, K. W., Ko, Y. B., & Park, S. J. (2009, February). A hybrid approach for clustering-based data aggregation in wireless sensor networks. In Digital Society, ICDS'09. Third International Conference on (pp. 112-117). IEEE, 2009.

[12] Mr. Santosh.Irappa.Shirol, Ashok Kumar. N, Mr. Kalmesh.M. Waderhatti," Advanced-LEACH Protocol of Wireless Sensor network", IJETT - Volume4 Issue6- June 2013.

[13] Chunyao FU, Zhifang JIANG, Wei WEI and Ang WEI," An Energy Balanced Algorithm of LEACH Protocol in WSN", IJCSI-2013.

[14] K. Latif, A. Ahmad, N. Javaid, Z. A. Khan and N. Alrajeh, "Divideand- Rule Scheme for Energy Efficient Routing in Wireless Sensor Networks", The 4th International Conference on Ambient Systems, Networks and Technologies (ANT 2013), 2013,

[15] Raju, G. T., D. K. Ghosh, T. Satish Kumar, S. Kavyashree, and V. Nagaveni. "Wireless sensor network lifetime optimization." (2011): 244-248.