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Balancing the Energy Consumption in Wireless Sensor Network by Forming the Topography and Base Station Dynamically

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ABSTRACT: Wireless sensor network is a wireless network containing number of nodes that cooperatively monitors an environment. Each network contains a node containing sensor, memory and communicating device. The sensor senses the environment and sends those data to the base station or sink node. One of the major problems in these networks consists in reducing energy consumption to a minimum in such a way as to maximize a network life time. Here in the existing system, it proposes the algorithm called General Self-Organized Tree Based Energy Balance Routing (GSTEB). It explores a balance between the relay hop count of local data aggregation and moving tour length of the data collector. It optimizes the problem by polling points. But the drawback is that localization between the nodes is not considered. So in the proposed system, the paper explains by providing the localization concept.

KEYWORDs: WSN, GSTEB, Self-Organized, Network lifetime, Routing protocol, EDAL

I.INTRODUCTION

A wireless sensor network (WSN) of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

Wireless sensor networks (WSNs) have gained world- wide attention in recent years, particularly with the proliferation in Micro-Electro-Mechanical Systems (MEMS) technology which has facilitated the development of smart sensors. These sensor nodes can sense, measure, and gather information from the environment and, based on some local decision process, they can transmit the sensed data to the user. Another concept in Wireless Sensor Network is Clustering, which means Grouping of similar objects or sensors in our context i.e., distance or proximity, logical organizing.

Wireless sensor networks have the ability to deal with node failures. They have dynamic network topology. Further developments in this technology have led to integration of sensors, digital electronics and radio communications into a single integrated circuit (IC) package. Generally wireless sensor network have a base station that communicates through radio connection to other sensor nodes. The required data collected at sensor node is processed, compressed and sent to gateway directly or through other sensor nodes.

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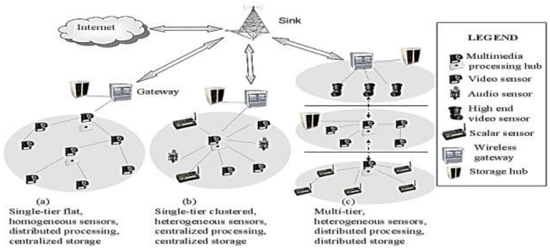

Fig 1 The Architecture of WSN network

II.RELATED WORK

Hierarchical clustering in WSNs can greatly contribute to overall system scalability, lifetime, and energy efficiency. Hierarchical routing is an efficient way to lower energy consumption within a cluster, performing data aggregation and fusion in order decrease the number of transmitted messages to the BS. On the contrary, a single-tier network can cause the gateway to overload with the increase in sensors density. Such overload might cause latency in communication and inadequate tracking of events. In addition, the single-tier architecture is not scalable for a larger set of sensors covering a wider area of interest because the sensors are typically not capable of long-haul communication.

One of the first and most popular clustering protocols proposed for WSNs was LEACH (Low Energy Adaptive Clustering Hierarchy) It is probably the first dynamic clustering protocol which addressed specifically the WSNs needs, using homogeneous stationary sensor nodes randomly deployed, and it still serves as the basis for other improved clustering protocols for WSNs. It's an hierarchical, probabilistic, distributed, one-hop protocol, with main objectives (a) to improve the lifetime of WSNs by trying to evenly distribute the energy consumption among all the nodes of the network and (b) to reduce the energy consumption in the network nodes (by performing data aggregation and thus reducing the number of communication messages). It forms clusters based on the received signal strength and also uses the CH nodes as routers to the BS. All the data processing such as data fusion and aggregation are local to the cluster. LEACH forms clusters by using a distributed algorithm, where nodes make autonomous decisions without any centralized control. All nodes have a chance to become CHs to balance the energy spent per round by each sensor node. Initially a node decides to be a CH with a probability " p" and broadcasts its decision. Specifically, after its election, each CH broadcasts an advertisement message to the other nodes and each one of the other (non-CH) nodes determines a cluster to belong to, by choosing the CH that can be reached using the least communication energy (based on the signal strength of each CH message.

Generally, LEACH can provide a quite uniform load distribution in one-hop sensor networks. Moreover, it provides a good balancing of energy consumption by random rotation of CHs. Furthermore, the localized coordination scheme used in LEACH provides better scalability for cluster formation, whereas the better load balancing enhances the network lifetime. However, despite the generally good performance, LEACH has also some clear drawbacks. Because the decision on CH election and rotation is probabilistic, there is still a good chance that a node with very low energy gets selected as a CH. Due to the same reason, it is possible that the elected CHs will be concentrated in one part of the network (good CHs distribution cannot be guaranteed) and some nodes will not have any CH in their range. Also, the CHs are assumed to have a long communication range, so that the data can reach the BS directly. This is not always a realistic assumption because the CHs are usually regular sensors and the BS is often not directly reachable to all nodes. Moreover, LEACH forms in general one-hop intracluster and intercluster topology where each node should transmit directly to the CHs and thereafter to the BS, thus normally it cannot be used effectively on networks deployed in large regions.

Carrier sense multiple access (CSMA) is a probabilistic media access control (MAC) protocol in which a node verifies the absence of other traffic before transmitting on a shared transmission medium, such as an electrical bus, or a band of the electromagnetic spectrum. Carrier sense means that a transmitter uses feedback from a receiver to determine whether another transmission is in progress before initiating a transmission. That is, it tries to detect the presence of a

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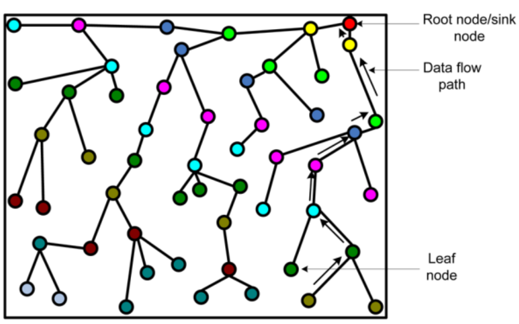
carrier wave from another station before attempting to transmit. If a carrier is sensed, the station waits for the transmission in progress to finish before initiating its own transmission. In other words, CSMA is based on the principle "sense before transmit" or "listen before talk". Multiple access means that multiple stations send and receive on the medium. Transmissions by one node are generally received by all other stations connected to the medium.
We propose a model for the energy consumption of a node as a function of its throughput in a wireless CSMA network. We first model a single-hop network, and then a multi-hop network. We show that operating the CSMA network at a high throughput is energy inefficient since unsuccessful carrier sensing attempts increase the energy consumption per transmitted bit. Operating the network at a low throughput also causes energy inefficiency because of the increased sleeping duration. Achieving a balance between these two opposite operating regimes, we derive the energy-optimum carrier-sensing rate and the energy-optimum throughput which maximizes the number of transmitted bits for a given energy budget. For the single-hop case, we show that the energy-optimum total throughput increases as the number of nodes sharing the channel increases. For the multi-hop case,we show that energy-optimum throughput decreases as the degree of the conflict graph corresponding to the network increases. In both cases, the energy-optimum throughput reduces as the power required for carrier-sensing increases. The energy-optimum throughput is also shown to be substantially lower than the maximum throughput and the gap increases as the degree of the conflict graph increases for multi-hop networks.

III EXISTING SYSTEM

GSTEB is a self-organizing protocol to build a routing tree for prolonging the network lifetime in different applications. Each round, BS assigns a root node and broadcasts the ID and coordinate of the root node to other nodes. Then each node selects its parent in parallel using local information of its own and its neighbors. Because nodes only use local information to select their parents, GSTEB is a dynamic and parallel protocol, which can change the root and reconstruct routing tree with shorter delay and less overhead. Therefore a better balanced load is achieved, especially for dense nodes deployed.
The operation of GSTEB is divided into

- Initial Phase
- Tree Constructing Phase
- Self-Organized Data Collecting and Transmitting Phase, and
- Information Exchanging Phase.

Even though GSTEB needs BS to compute the topography, which leads to an increase in energy waste and a longer delay. Normally there are two definitions for network lifetime: a) the time from the start of the network operation to the death of the first node in the network. b) The time from the start of the network operation to the death of the last node in the network. In this paper, we adopt the first definition. Moreover, we consider two extreme cases in data fusion: Case (1) the data between any sensor nodes can be totally fused. Each node transmits the same volume of data no matter how much data it receives from its children. Case (2) the data can’t be fused. The length of message transmitted by each relay node is the sum of its own sensed data and received data from its children.



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IV. PROPOSED SYSTEM

The Proposed system here used is EDAL which stands for Energy efficient Delay-Aware and Lifetime balancing data collection protocol for WSN. Since individual nodes' data are often correlated in a micro sensor network, the end user does not require all the (redundant) data; rather, the end user needs a high-level function of the data that describes the events occurring in the environment. Because the correlation is strongest between data signals from nodes. This allows all data from nodes within the cluster to be processed locally, reducing the data set that needs to be transmitted to the end user. In particular, data aggregation techniques can be used to combine several correlated data signals into a smaller set of information that maintains the effective data (i.e., the information content) of the original signals. Therefore, much less actual data needs to be transmitted from the cluster to the base station (BS). EDAL protocol reduces the computational cost for finding the root node and also tree forming. When the data is transmitted to the relay nodes but it does not reach to the base station then the root node broadcast the packet to the child node. In this protocol the hello packet will send only to the cluster member in the group and not to the everyone in the group.

V. SIMULATION SETUP AND RESULT

Simulation is done in NS2.The compiled objects are made available to the OTCL interpreter through an OTCL linkage that creates a matching OTcl object for each of the C++ objects and makes the control functions and the configurable variables specified by the C++ object act as member functions and member variables of the corresponding OTcl object. It is also possible to add member functions and variables to a C++ linked OTcl object.

NS- All in one V2.30 Ns is the object oriented TCL (OTCL) Script interpreter that has a simulation event schedule and network component object libraries and network setup module libraries. To run the simulation network the user should write an OTCL. Script language that initiated event scheduler and tells network traffic source went to start and stop transmitting package. Another important tool NAM which is used for Network Animation. Xgraph tool is used for plotting the NAM log file.

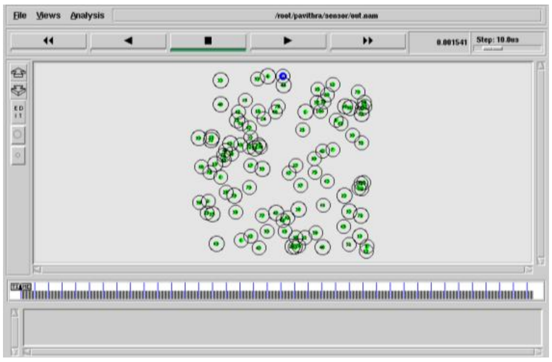

Fig. No.1 Beacon Update

The above figure shows that the child nodes are updating their ID coordinates and energy level of each node to the base station.

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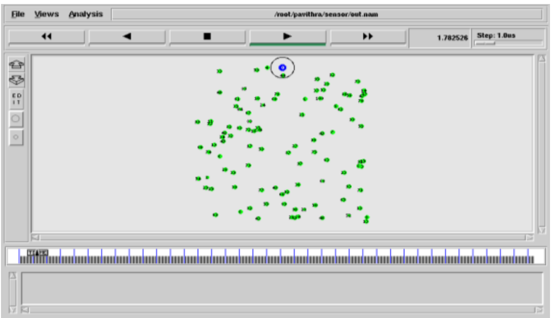

Fig.No.2 Base Station BroadCast

Once the base station selects the root node then it broad cast the root node ID to all its cluster member in the group and it can be shown in the fig no.2. Once the base station forms the primal clusters, they will not change much because all sensor nodes are immobile, whereas the selected cluster head in the same cluster may be different in each round. During the first round, the base station first splits the network into two sub clusters, and proceeds further by splitting the sub clusters into smaller clusters. The base station repeats the cluster splitting process until the desired number of clusters is attained. When the splitting algorithm is completed, the base station will select a cluster head for each cluster according to the location in formation of the nodes. For a node to be a cluster head, it has to locate at the centre of a cluster. Once a node is selected to be a cluster head, it broadcasts a message in the network and invites the other nodes to join its cluster. The other nodes will choose their own cluster heads and send join messages according to the power of the many received broadcast messages. When the cluster head receives the join message from its neighbor node, it assigns the node a time slot to transmit data.

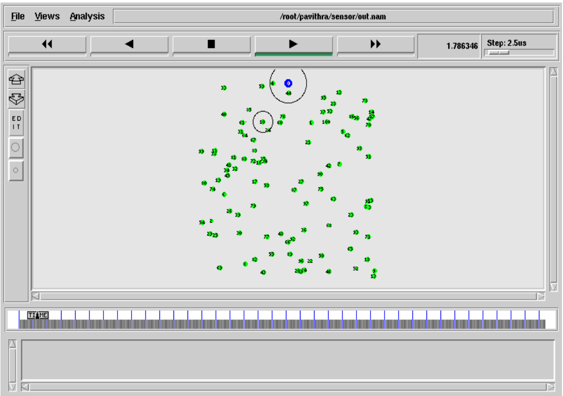

Fig No.3 Route Finding

Each node tries to select a parent in its neighbors using EL and coordinates which are selected as cluster head it is shown in fig no.3. For a sensor node, the distance between its parent node (CH) and the root should be shorter than that between itself and the root (Sink). The process of Tree Constructing Phase can be regarded as an iterative algorithm. For a sensor node, only the nodes with the largest EL of all its neighbors and itself can act as relay nodes. If the sensor node itself has the largest EL, it can also be considered to be an imaginary relay node. Choosing the parent node from all the relay nodes is based on energy consumptions. Any of these consumptions is the sum of consumption from the sensor node to a relay node and that from the relay node to BS. The relay node which causes minimum consumption will be chosen as the parent node. It is true that this relay node should choose its parent node in the same way. So a path with minimum consumption is found by iterations

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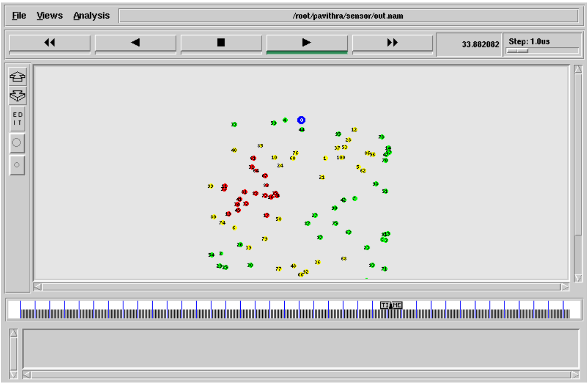

Fig No.4 Decrease in energy level

When the energy level of each node become low it can be indicated in different colors. Once the energy decreases in the node then the children node selects its neighbour node as root node and broad its data to its base station and it is shown in fig no.4.The below graph shows the variation between numbers of nodes and their time in msec. Fig no. 5 shows the GSTEB delay while transmitting their data packets to the base station.

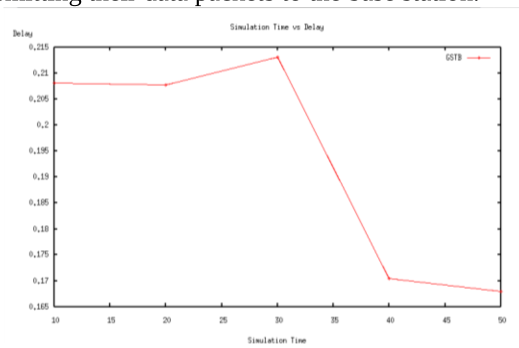

Fig No. 5 GSTEB Delay

Fig no.6 describes that GSTEB loss while constructing the root node and forming the routing tree for data transmission between a root node and child node.

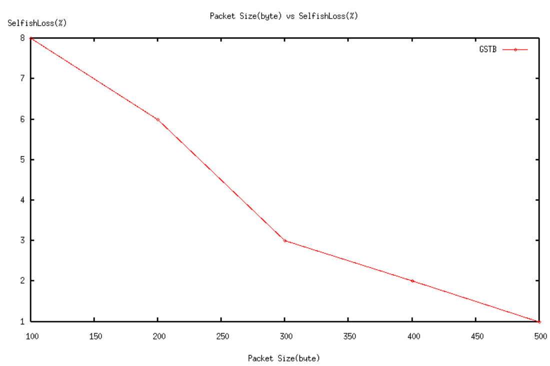

Fig No. 6 GSTEB LOSS

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VI. CONCLUSION AND FUTURE ENHANCEMENT

Death pattern of nodes in exist protocol is such that a sub section of sensor field is not cut-off from the rest of the sensor nodes, even after the death of several nodes. In our process will increases the life time of the node and reduce the energy computation. Energy efficiency—getting more from our limited resources through improved technologies and practices—contributes to more profitable business operations, cheaper and more plentiful energy for households, growing economies for countries, and a cleaner environment Energy efficiency can be defined as the level of energy consumption to provide a given service, and typically refers to an improvement in this relationship. Our proposed algorithm can control the overhead generated by improved packet delivery ratio. The future work could be to investigate different methods to further limit the traffic or load and compare the algorithm for other proactive and reactive routing protocols.

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