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Energy Consumption of Tree Based Hierarchical Approach in WSN

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ABSTRACT

In WSN, there are so many sensors, just sends the data to the base station. Base station is the controller of whole WSN. Here this paper shows how BS can communicate to direct closest node as CH and further node can also elected as S-CH. Here CBR protocol used to work on energy consumption based on the format of tree for collecting the data. Represent the chart & C – language implementation of node wise energy consumption both sending as well as receiving. Also node A can communicate to BS direct with distance measurement.

1. INTRODUCTION

A WSN as a finest having rules i.e. energy (power) validation from every sensor hub is comprised the battery or energy device with a restricted energy (power) provide to job. Likewise, not easy task to replace the battery in different environment there may be very rough or exhaustive in a few different situations. On the other side, the wireless sensor system says that there may be enough energy to complete the task or can gather the information easily. Along these words of WSN. Such kind of system build that can protect the fundamental matter in the arrangement of sensor in to the environment. There are so many ways to maximize the life cycle of network in WSN. This will be a typical to task to create the mind relax system that can help to collect the data and as well as less energy usage. In this dissertation, focus with the giving direction of spreading the nodes into hostile area further to improvement of energy usage should be less. This works add something new into sensor networks in the phase of advancement of technology.

Unique characteristics of a WSN include:

- Limited power they can harvest or store
- Ability to withstand harsh environmental conditions
- Ability to cope with node failures
- Mobility of nodes
- Dynamic network topology
- Communication failures
- Heterogeneity of nodes
- Large scale of deployment
- Unattended operation
- Node capacity is scalable, only limited by bandwidth of gateway node.

Sensor networks are needed in the applications like environment monitoring, industrial control units, military applications and in the context aware computing environments. Based on this critical expectation, in many crucial WSN applications the sensor nodes are often deployed randomly in the area of interest by relatively uncontrolled means (i.e., dropped by a helicopter) and they form a network in an ad hoc manner [1, 2].

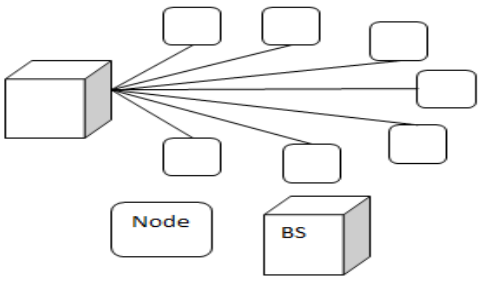

Fig 1. WSN architecture.

Figure.1 shows a typical WSN architecture. The nodes sense the information and transmit it to the base station through an intermediate node called the cluster-head (CH). The cluster-head aggregates the data, compresses it and then sends it to the base station. The base station serves as a gateway node to sends the data to another network. The database connected to the base station provides the means to update and retrieve the data on-demand.

1.1 Hardware, Software & OS

1.1.1 Sensor node

The main challenge is to produce low cost and tiny sensor nodes. With respect to these objectives, current sensor nodes are mainly prototypes. Miniaturization and low cost are understood to follow from recent and future progress in the fields of MEMS and NEMS. Some of the existing sensor nodes are given below. Some of the nodes are still in research stage.

1.1.2 Software

Energy is the scarcest resource of WSN nodes, and it determines the lifetime of WSNs. WSNs are meant to be deployed in large numbers in various environments, including remote and hostile regions, with ad-hoc communications as key.

For this reason, algorithms and protocols need to address the following issues:

- Lifetime maximization
- Robustness and fault tolerance
- Self-configuration

Some of the "hot" topics in WSN software research are:

- Security
- Mobility (when sensor nodes or base stations are moving)

Middleware: the design of middle-level primitives between the software and the hardware.

1.1.3 Operating Systems

Operating systems for wireless sensor network nodes are typically less complex than general-purpose operating systems both because of the special requirements of sensor network applications and because of the resource constraints in sensor network hardware platforms. For example, sensor network applications are usually not interactive in the same way as applications for PCs. Because of this, the operating system does not need to include support for user interfaces. Furthermore, the resource constraints in terms of memory and memory mapping hardware support make mechanisms such as virtual memory either unnecessary or impossible to implement.

WSNs have one or more centralized control units called the base station or gateway. The base station serves as a gateway for each sensor node to send data to another network (Figure 1). Thus it can be an interface to interact with the network, to extract and transfer information to the sensor nodes. Unlike nodes, base stations are many times more powerful and have an AC power supply, high communication bandwidth, and larger processing power and storage facilities.

The energy consumption in a WSN can be reduced by allowing only some nodes to communicate with the base station. These nodes called cluster-heads [3] [4] [5] collect the data sent by each node in that cluster, compressing it and then transmitting the aggregated data to the base station [7]. The model is suitable considering the amount of redundancy found in WSNs; direct transmissions the base station will consume large amount of transmit power from each node.

2. PROTOCOLS BACKGROUND

To defeat the weaknesses of customary directing and information spread conventions, which keep running on top of no layered or level system structures, a bunching - based convention, called Low Energy Adaptive Clustering Hierarchical (LEACH) was proposed in Ref. [3]. Drain Shown in Fig 2.2 depends on an information conglomeration or information combination system that consolidates or totals the first information into a littler size of information that hold just significant data of every individual sensor. For this reason, LEACH partitions a system into numerous bunches of sensor hubs, which are developed by utilizing restricted coordination and keep up not just to lessen the measure of information that are transmitted to the sink or base station, additionally to make steering and information dispersal more solid, adaptable and strong. Given that the vitality dissemination of the sensors relies on upon the separation and the information size to be transmitted, LEACH endeavors to transmit information over short separations and lessen the quantity of transmission and gathering operations.

Another enhanced and exceptionally well known vitality proficient convention is HEED (Hybrid Energy Efficient Distributed Clustering [4]). Notice is a various leveled, disseminated and bunching procedure in which a solitary bounce transmission example is held inside of every group, in multi-jump transmission is permitted in the middle of CHs and the BS. The CHs are picked taking into account two fundamental necessities, leftover vitality (RE) and intra-bunch correspondence cost. (RE) of every hub is utilized to probabilistically select the introductory gathering of CHs. On the other side, intra-group correspondence cost mirrors the hub degree or hub's closeness to the neighbor hub and is utilized by the hubs as a part of choosing to join a bunch or not.

Rather than making any group, Power effective GAthering in Sensor Information Systems (PEGASIS) in Fig 2.3 [5] makes a chain of sensor hubs where every sensor hub transmits and gets information from a neighbor and at once stand out hub can send information to the sink or BS. Information's are accumulated at the hubs when they move starting with one hub then onto the next hub. It is demonstrated that PEGASIS can beat LEACH by around 100 300% for recognize system sizes and system topologies. Be that as it may, it causes long dormancy for hubs situated at a separation on the chain from BS. It is likewise subject to single purpose of disappointment in the event that the single pioneer on the chain comes up short which is additionally the explanation behind execution bottleneck of the framework.

Threshold sensitive Energy Efficient Network Protocol (TEEN) [6] joins both information driven and progressive methodology. Rather than having a level bunching of hubs such as LEACH or PEGASIS, TEEN structures multi-level grouping so as to peck order of hubs closer hubs into groups on the main level, then on the second level thus on until the sink hub is come to. Teenager tries to lessen vitality utilization by diminishing the quantity of transmissions with the guide of two limits as telecast by the bunch heads after the groups are made hard and delicate edges.

A novel Cluster Based Routing (CBR) Protocol [7] for prolong the sensor network lifetime. CBR Protocol achieves a good performance in terms of lifetime by balancing the energy load among all the nodes. In this protocol first we Cluster the network by using new factors and then construct a spanning tree for sending aggregated data to the base station which can better handle the heterogeneous energy capacities. Simulation results show that CBR Protocol [7] can remarkably extend the network life time and amount of data gathered.

3. ENERGY CALCULATION BASED ON TREE FORMATION

The amount of redundancy found in WSNs; direct transmissions the base station will consume large amount of transmit power from each node. In this approach calculate the each node energy for both sends energy consumption or receiving energy consumption. The proposed work is successfully implemented in C –Language.

A. Cluster head selection Using CBR Protocol

Initially we have collection of nodes, so with help of CBR protocol [7] algorithm creates clusters or sub clusters of nodes in Fig 2, by which nodes come under in different clusters. Each node belongs to one cluster. Next level of working we find the sub cluster & also here we have six nodes A, B, C, D, E, F & G and finally a BS.

Node A is nearest to BS so elected as CH and further node B & node C elected as sub cluster head as per CBR protocol. And here is distance also enter from BS to nodw A.

Based on distance here find the sending energy consumption of each whomsoever in cluster or sub cluster. Also calculate the receiving energy consumption.

To calculate the sending energy with using following formula:

$$E(t) = (E(elec) * k) + (E(amp) * k * d * d)$$

To calculate the receiving energy consumption formula of each node:

$$E(t) = (E(elec) * k)$$

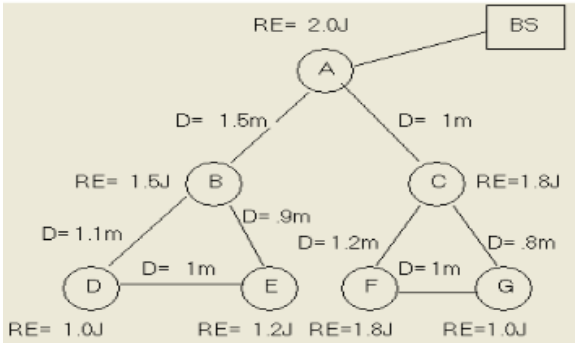

Fig 2. Tree formation using CBR Protocol.

Table 1. Parameters.

Parameter	Definition	Unit
E (elec)	Energy dissipation rate to run the radio	50nJ / bit
E(amp)	Energy dissipation rate to run transmit amplifier	100 pJ / bit /m2
K	Data length	bit (8)
D	Node transmission Range	M

B. Energy Calculation of Each Node

Here is C-language implementation of calculation of each node shown in fig 3.

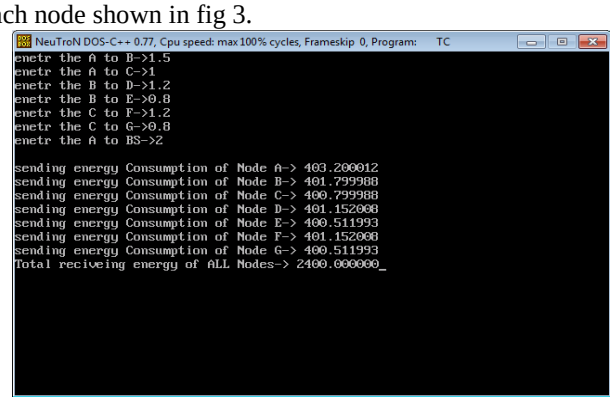

Fig 3. Energy calculation.

Table 2. Node wise Sending Energy Consumption.

Node	Sending Energy Consumption
Node A	403.200012
Node B	401.799988
Node C	400.799988
Node D	401.152008
Node E	400.511993
Node F	401.152008
Node G	400.511993

Table 2 also show the data of energy consumption & fig 4 Represents a chart of node wise pillar of how energy consume by each node.

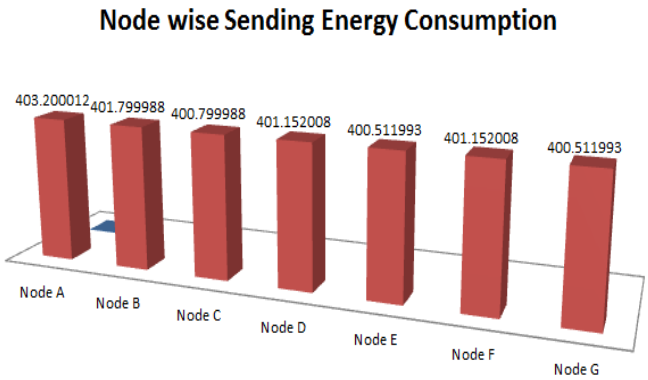

Fig 4. Chart of node wise energy.

4. CONCLUSION

In WSN, there are so many sensors, just sends the data to the base station. Base station is the controller of whole WSN. Here this paper just show how energy consume by each node using CBR protocol also represent how tree based architecture is helpful to find out the CH as well as SCH (sub-CH). This paper is implementation of energy calculation of CBP protocol in C-language.

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