Available online at www.elixirpublishers.com (Elixir International Journal)

Network Engineering

Elixir Network Engg. 120 (2018) 51226-51229

ISSN: 2229-712X

Node Location Based Clustering in Wireless Sensor Network

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ARTICLE INFO

Article history:

Received: 9 June 2018;

Received in revised form:

29 June 2018;

Accepted: 7 July 2018;

Keywords

Wireless Sensor Network,
Clustering,
Energy,
Cluster head,
K-Mean.

ABSTRACT

In Wireless Sensor Networks, having two types of approaches non-clustering & clustering based. In both cases the prime role in network is energy consumption to transmit the data that will decide the life time of network. So this paper focused on the energy consumption. This research paper works for generation or formation of cluster & how to select the cluster head by which consideration of energy consumption should be less than non-clustering approach. In this research paper to create the cluster, implement the K-Mean algorithm to select the cluster head based on the nearest node to the location of centre of cluster. This paper considers the sending energy consumption of each node in the whole network in both cases i.e. non-clustering & clustering

Introduction

A wireless sensor networks as a rule has vitality limitation because of every sensor hub needs battery with a restricted vitality supply to work. Likewise, reviving or supplanting sensor battery may be less than ideal and unfeasible in a few situations. On the other side, the Wireless sensor system ought to work sufficiently long to consideration fulfill the application prerequisites. Along these lines, vitality protection is a fundamental matter in the arrangement of Wireless sensor systems. There are disparate ways to deal with protect vitality tradition and drag out the system lifetime or prolong in WSN. The key way to deal with improve vitality use in WSN is the development of vitality mindful system conventions. In this dissertation display an audit of directing and bunching calculations for force protection in Wireless sensor systems. This additionally show a force mindful bunching strategy for improving the system lifetime and also growing the quantity of effectively conveyed bundles and diminishing the system delay time.

There are several key attributes that designers must carefully consider, which are of particular importance in wireless sensor networks.

- Cost of nested clustering
- Selection of Cluster heads and sub cluster heads
- Synchronization
- Data Aggregation
- Repair Mechanisms
- Quality of Service (QoS)

A WSN commonly comprises of an expansive number of low cost, low power and multiple functional sensor hubs that are conveyed in an area of consideration. These sensor hubs are little in size, yet are furnished with sensors, implanted chip, and radio handsets, and correspondingly have to finding ability, as well as information controlling and conveying capacities. They impart over a short separation by means of a remote medium and communicate with other to finish a typical undertaking, for instance, environment checking, combat zone watch, and modern procedure control. Contrasted and customary remote correspondence systems, for instance, cell frameworks and mobile adhoc [12] network; sensor systems have the accompanying restrictive attributes and limitations:

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.

Network Design Objectives

The qualities of sensor systems and necessities of various applications decisively affect the system outline targets regarding system capacities and system execution. The primary plan targets for sensor systems incorporate the accompanying a few angles:

Little Node Size

Lessening hub measure is one of the essential outline targets of sensor systems. Sensor hubs are typically conveyed in a brutal or unfriendly condition in substantial numbers. Lessening hub size can encourage hub arrangement, and furthermore diminish the cost and power utilization of sensor hubs.

Low Node Cost

Diminishing hub cost is another essential plan target of sensor systems. Since sensor hubs are typically conveyed in a brutal or threatening condition in huge numbers and can't be reused, it is vital to decrease the cost of sensor hubs with the goal that the cost of the entire system is diminished.

Low Power Consumption

Diminishing force utilization is the most vital goal in the outline of a sensor arrange. Since sensor hubs are fueled by battery and usually exceptionally troublesome or even difficult to change or revive their batteries, it is urgent to lessen the power utilization of sensor hubs with the goal that the lifetime of the sensor hubs, and also the entire system is delayed.

Self - Configurability

In sensor systems, sensor hubs are typically sent in an area of enthusiasm without watchful arranging and building. Once conveyed, sensor hubs ought to have the capacity to independently arrange themselves into a correspondence organize and reconfigure their availability in case of topology changes and hub disappointments.

Adaptability

In sensor organizes, the quantity of sensor hubs might be on the request of tens, hundreds, or thousands. Along these lines, arrange conventions intended for sensor systems ought to be versatile to various system sizes.

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].

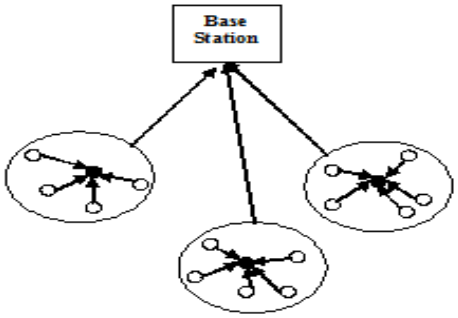

Fig. 1. Cluster architecture in WSN.

- Cluster Head
- Cluster Node

Figure.1 shows a typical cluster-based 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.

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.

Background

Many greedy algorithms have been proposed to choose cluster heads in ad hoc networks, and wireless sensor networks. They are based on the criteria of highest degree, lowest- ID, highest-ID, and node-weight, residual energy, probability, and any combination of these. The clustering techniques can also be classified based on cluster size, namely Single hop, and Multi-hop. LEACH [8] (Low-Energy Adaptive Clustering Hierarchy) elects cluster heads based on randomly generated value between 0 and 1. If this randomly generated value is less than threshold value then the node becomes cluster head for the current round. LEACH [11] is the first tree based cluster-based routing protocol for wireless sensor network which divides the nodes into clusters, in each cluster a node with extra privileges called Cluster Head (CH) is responsible for creating and manipulating a TDMA (Time division multiple access) schedule and sending aggregated data from nodes to the BS where these data is needed using CDMA (Code division multiple access). Remaining nodes are cluster nodes. PEGASIS (power-efficient gathering in sensor information systems) [6] [7] is an improvement over LEACH by making only one node transmit data to the base station in this protocol every node transmits it's data only to its nearest/neighbor node in the data fusion phase. PEGASIS starts with the farthest node from the base station. HEED (Distributed Clustering in Ad-hoc Sensor Networks: A Hybrid, Energy-Efficient Approach) [9] periodically selects cluster heads according to a combination of their residual energy (RE), and communication cost of nodes. Distributed Weight-Based Energy-Efficient Hierarchical Clustering (DWEHC) [10] is an extension or modified version of the HEED. It claims to provide more balanced cluster size. HEED uses two clustering parameter to select CH: one is residual energy, and the other is communication cost.

In HEED, each node must be mapped to exactly one cluster, and each node belongs to its only CH within one hop. After a clustering process, each node can either elect to become a CH due to a probability or join a cluster according to CH messages.

Proposed Work

The amount of redundancy found in WSNs; direct transmissions the base station will consume large amount of transmit power from each node. In clustering approach, instead of sensor nodes sending the data to the base station here data send to the cluster-heads. This paper wants to save power consumption of whole network by this architecture because node communicates with cluster head & CH further communicates with BS consumes less energy than non - clustering approach. The proposed algorithm is successfully implemented in MATLAB R2009b.

A. Cluster head selection using kmean

Initially WSN, there is collection of nodes, so with help of KMEAN algorithm [13] [14] creates clusters of nodes in Fig 2, by which nodes come under in different clusters. Each node belongs to one cluster or group. Next level of working find the center of group & also find the nearest node of center that node work as group head. Selected GH work for each node of respective group to collect data from nodes and send to the base station.

B. Node distance based GH Selection

Fig 2 shows preparing a cluster & find out the center of circle of cluster using K-Mean algorithm. Then next phase is to select the nearest node to the centre co-ordinates. That node will be work as group head (GH) or CH. All the nodes of cluster will communicate to the CH and sends own sense

data to CH or GH. Group head aggregates the collected data and sends to the base station of the network.

C. Energy Calculation

To calculate the energy focused on two approaches:

1) Non-Clustering

In non-clustering each node directly communicates to the base station (BS) or sink node. So, calculates the energy consumption of each node.

$$E_{Sink} = \sum_{k=1}^{k=n_g} Node_k$$

2) Clustering: Node location based GH selection approach

In clustering each node sends the data to own GH. So need to calculate the sending energy consumption of each node.

$$E_{GH} = \sum_{k=1}^{k=n_g} Node_k$$

$$E(total) = (E_{GH}) + (E_{GHtoSink})$$

$Node_k$= Nodes of Group

E_{GH} = Sending energy of Group

E(total) = Total energy

$E_{GHtoSink}$ = CH to Sink Node energy

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:

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

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
DA	Data Aggregation	5nj/bit

3) Comparison between non - clustering & node location based clustering

Fig 3 depicts graph of energy between non - clustering & node location CH or GH selection approach. This graph drawn based on number of nodes in cluster & energy consumption in non - clustering & node distance based CH or GH selection approach. Fig 3 depicts that energy consumption in non - clustering is more in comparison of node location CH selection approach.

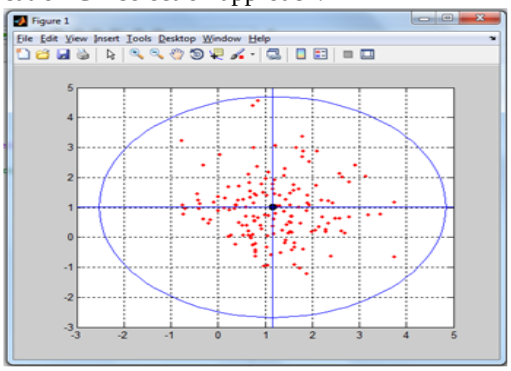

Fig 2. Cluster-Group Formation.

Cluster head or Group head Nodes

(-3,-3) Sink or Base station Locatio

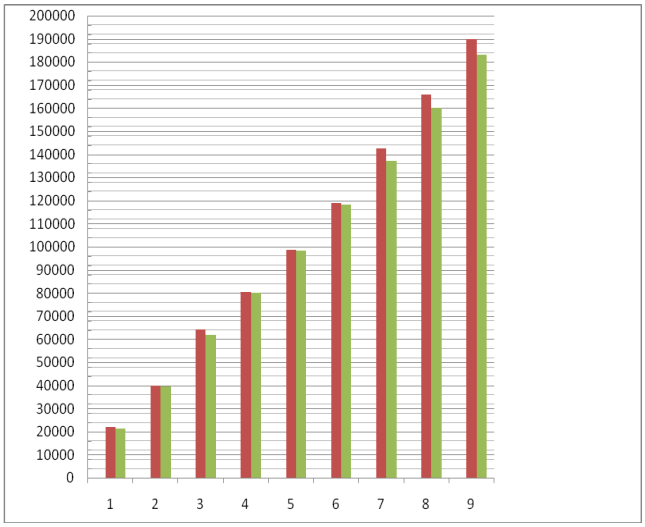

Fig3. Sending Energy Consumption Graph between Non – clustering & Node Location based CH selection approach.

X-Axis→Number of Node (×100)

Y-Axis→Sending Energy consumption (nano joule)

Non-Clustering

Node location based Clustering

Conclusion

In clustering, the cluster head decision is a major challenge. If network is taken as a whole, then the energy consumption can be optimized by the rotation of this cluster head inside the individual clusters. This paper mainly focused on non-clustering & node location based CH selection approach for energy consumption of Wireless Sensor Network. The approach involves the concept which represents the different steps that are performed to conserve the energy of on non-clustering & node location CH selection approach in wireless sensor networks. In this paper, a new technique is proposed to select cluster head among some of the wireless sensor nodes based on distance from CH. The proposed node location based CH selection approach used to increase & improve the lifetime of the network.

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