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An Energy Efficient Protocol for Evaluating Performance of Cluster Based WSN

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Abstract

The wireless sensors networks is that the powerful space for providing all wireless networking support and fulfill the customers necessities. During this paper we tend to measure the performance of the WSNs and deploy the H-HEED protocol that supports the heterogeneity environment. The H-HEED protocol is that the efficient protocol and run on base stations additionally as nodes communication. Sensor nodes could change their location once initial deployment. Quality may result from environmental influences such as wind or water, sensing element nodes could also be hooked up to or carried by mobile entities, and sensing element nodes could possess automotive capabilities. In other words, quality could be either associate incidental aspect impact, or it's going to be a desired property of the system. The clustering technique adapts by the on top of same protocol and reenergized the networks in order that the performance of this protocol was higher than alternative causing protocol. This paper calculates the general energy and delay performance using NS2 network machine. The detailed clarification given in the Experimental Result section.

Keywords: *Sensor nodes, H-HEED, energy, delay, 802.15, CH.*

Introduction

The sensor nodes [8] are self-contained units equipped with a radio transceiver, a small microcontroller, and an energy source, usually a battery. Recently, acoustic sensors have also been built for underwater monitoring. All WSNs should provide querying ability. A user may want to query an individual node or a group of nodes for information collected in the region as shown in the figure1.

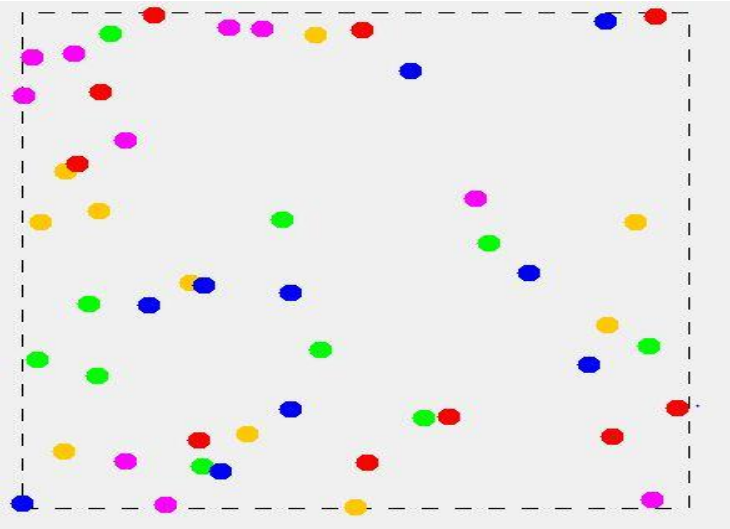

Figure 1: WSN Networks

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Depending on the amount of data fusion performed, it may not be feasible to transmit a large amount of the data across the network. Instead, various local sink nodes will collect the data from a given area and create summary messages. A query may be directed to the sink node nearest to the desired location.

In most WNSs, the sensors typically rely on each other to transport data to a monitoring computer. The nodes dynamically self-organize their network topology based on various network conditions, rather than having a preprogrammed network topology. There are many ways to classify the WSNs [8]. One way is whether the nodes are individually addressable, and another is whether the data in the network are aggregated.

The main task of sensor network is to forward the sensing data gathered by sensor nodes to the base station. One simple approach to the fulfillment of this task is direct data transmission. In this case, each node in the network directly sends sensing data to the base station. However, if the base station is remote from the sensor node, the node will soon die for suffering excessive energy consumption for delivering data.

2. Related work

In [1] compared the different schemes in the wireless sensor network field. The clustering scheme is applied in the sensor networks and configured clustering approach. The Authors uses LEACH protocol and calculates the consumption of the energy. The assumption requires that a cluster member can know the existence of a cluster head within the transmission range. The LEACH protocol has well defined by the authors and avoiding reclustering in the sensor networks. Further a TDMA technique applied in the clustered networks and proper head selection procedure discussed.

Energy consumption can be affected by all layers of the network, ranging from physical to application layer [3]. However, this traditional layer-wise approach leads to independent design of different layers and results in higher margins. At the physical layer, the modulation and the power transmission are the main adjustment parameters for an energy efficiency communication. The different cases has been explained i.e. single hop, Mutihop and delay constraints and they reduce the energy consumption up to 49%.

In [6], to deal with the heterogeneous energy circumstance, the node with higher energy should have larger probability of becoming the cluster head. In this paper, each node must have an estimate of the total energy of all nodes in the network for compute the probability for becoming a cluster head. As a result, each node cannot make a decision of becoming a cluster head only by its local information, so the scalability of this protocol will be influenced.

2.1 H-HEED Protocol

Heterogeneous Hybrid Energy Efficient Distributed protocol (H-HEED) [9] is the

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modified protocol of the HEED protocol that communicates between head to head communications. The cluster selection approach has been used for providing efficient communication in the 802.15 networks. It also reenergized the network to improve the overall performance. The overall energy required for transmission and reception of data is formulated by source and sink. According to node energy, energy levels are classified in terms of its energy required for transmission and reception of data. It is easy to calculate the energy efficiency. The concept of introducing new nodes is done in order to prolong the lifetime of the network. After a few transmissions, the network is re-energized [9]. The equation (1) given below is calculating the energy.

$$\mathrm{E}(\gamma intra)^n = \sum_{i=0}^{k} \mathrm{E}(\mathrm{Ci}|\gamma intra) + \sum_{(i,j)\epsilon D}^{|D|} \mathrm{E}(\mathrm{Ci}|\gamma inter)$$

(1)[7]

Ci is number member nodes in ith cluster. We also define the inter-cluster energy consumption function for the transmission link between CHi and CHj. where, Cij is the number of multi-hop traffic relayed by Chi node. The overall energy consumption of the entire network can be represented as a function of γintra. Where, k is the total number of clusters in the network and D is the set of all edges for the inter-cluster communication path (routing) contained in the spanning tree [7].

3 System Model

The system model defines the network area where the nodes communicate with the neighbor nodes/sink node/cluster head. Each node builds its routing table only when the communication between nodes is explicitly needed for forwarding packets. Routing overhead can be significantly reduced in low traffic condition or if the topology is slowly varying, since there is no need to route information periodically or to maintain routes on which there is no traffic. There are n nodes that spread over the planar network with size 1000mx1000m.The approach used in this planar network is decentralized and communicates over networks animator tool[5].The cluster are well formatted and each cluster head also communicates with other cluster head/sink node. The model that is related to dynamic topology means the networks was not steady and the routing table information stored in every node shown in figure 2. The directed graph formed in this network that's why the each channel (arc) directly connected to the other node.

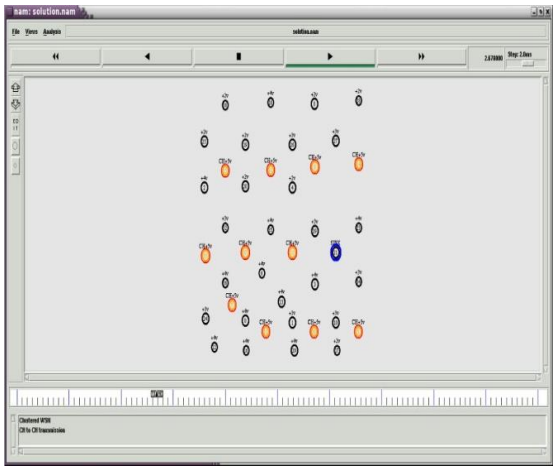

Figure 2: Simulation of WSN Networks

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Table 1: Simulation parameter

Sno	Parameter	Value
1	MAC type	Mac 802_15
2	Network Interface	Wirelessphy
3	Nodes	50
4	Max packet in queue	50
5	Antenna type	Omni directional antenna
6	Radio propagation model	Two ray ground
7	Channel type	Wireless channel
8	Ad hoc routing Type	AODV

The H-HEED Protocol works at the following stages and according to simulated in the simulation model:

Stage I: At the initial stage the all nodes formed a clustered network and choose one of the clustered head (CH) this head responsible for communication from one Network to the other network.

Stage II: when the clustered head assigned to each node then remaining idle channels (unwanted channels) are removed and placement of each channels according to the clustered head and base station(BS).

Stage III: if the remaining node (whenever CH not assigned) assigned the node/giving extra clustered head if the node more than 5.otherwise it adjust with already assigned clustered heads.

Stage IV: if the node having minimal energy then it goes sleep and active when the transmission occurs.

3.1 Algorithm Description

The experimental test-bed shown in figure 3, each node communicates with the sink node and formed a sensor network. These sensors node come under the category of clustered networks (the H-HEED protocol). The clustered formation used in this paper to avoiding the number of unwanted static channels. The spectrum used by the wireless sensor networks for providing heterogeneity of the channel availability. The following steps of H-HEED protocols enhanced the performance of the Leach protocol that also formed a clustered network [1]:

Step1: Every node broadcast the data to neighbor's node.

Step2: The CH node formed a clustered networks that's why each CH ϵ every node.

Step3: Every node having its own battery life and they give the information to sink (BS) node.

Step4: if the energy level > threshold value (average energy) then sensors nodes formed a join operation

Else Node performs a sleep operation (EL<TH and I ϵ CH(j)).

Step5: If join operation perform than every node ϵ CH broadcast the message (i, CH(j)).

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Step6: If the channel (C0) not freed means C0<0 then every node in the clustered in sleep mode until the C0 will be freed.

3.1.1 Analysis of the Algorithm

Each sensor node periodically cycles between an active state and a sleep state. Key parameters that characterize the duty cycle include sleep time, wake time, and the energy consumed during the active state and the sleep state [3]. The period of a duty cycle is equivalent to its sleep time plus the active time. On the basis of this reduced duty cycle several protocols have been analyzed [3]. The H-HEED protocol is one of them. From the above steps the H-HEED protocol formed clustered networks, the aim of this protocol maintaining the clustered networks and available up to date information. The multilevel approach used in this protocol for maintaining the energy level. From the above algorithm, the average energy is equals to the threshold value that value measures the energy level. The spectrum uses different channels for communication point of view, if the channel is static and number of nodes is excessive then there is problem for congestion. so we adapt an algorithm of Backoff [2,4] which is used in the above algorithm if the channel was busy then the nodes go sleep, it communicates when the channel was freed. The equation used c0<0; means no communication and active when greater than zero and reconstruct the clustered networks.

The number of trials has been performed in the wireless network and analyzed that when the number of clustered network increase then the overall time decreases, packet generation is more.

Table 2: Packet generation in cluster nodes

Number of Cluster Nodes	Time(s)	Packets generation
1	16.44	8
2	14.6	10
3	12.76	11
4	10.92	14
5	9.08	15
6	7.24	18
7	6.96	20
8	6.68	22
9	6.4	23
10	6.12	24
11	5.84	26

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4. Experimental Results

4.1 Energy consumption

In this paper the result shown in the figure 2 and equation defined in the section 2.1. This result specifies the performance of the remaining battery lifetime of WSNs when H-HEED protocol deploy on the network i.e. shown in figure2. The positive results found in the figure , in each fluctuated line the graph was reenergized and improves the performance.

Figure3: Energy Consumption

Figure4: Delay b/w WSN

4.2 Delay

The delay refers to the transmission of packet from sender to receiver node and it is directly propositional to the energy when we study the sensor networks. In this graph the delay consistently decrease when the number of nodes increases because the routing table information stored on each node when they communicate over the wireless scenario.

5. Conclusion

This paper discusses about the H-HEED protocol for providing effective communication between sink nodes as well cluster head nodes. Every node in the network communicates between the sink and cluster head node also measured the overall network performance. The proper route optimization technique should be used and H-HEED efficiently selects the cluster head; the channel selection and efficiently 802.15 spectrum uses by this paper and moreover the results better than previous work because of multilevel networks used.

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References

[1] Kiran Maraiya,Kamal Kant,Nitin Gupta, “Efficient Cluster Head Selection Scheme for Data Aggregation in Wireless Sensor Network”, International Journal of Computer Applications (0975 – 8887) Volume 23– No.9, June 2011.

[2] R. de Olivera, T. Braun, “TCP in Wireless Mobile Ad-Hoc Networks” Technical Report, IAM-02-03, University of Bern, Switzerland, Mar., (2003).

[3] Abdellah Chehri and Hussein T.Mouftah, “Energy Efficiency Adaptation for Multihop Routing in Wireless Sensor Networks ”, Journal of Computer Networks and Communications Volume 2012, Article ID 767920, 8 pages.

[4] Bhubneshwar Sharma and Mandeep Singh, " New Era Of Power Efficent Back-Off Algorithm Trend In Wireless Sensor Network ", International Journal of Electronics & Data Communication, Volume 1 No. 1, May, 2012.

[5] http://www.ns2.org

[6] W. R. Heinzelman, et al., "An Application -Specific Protocol Architecture for Wireless Microsensor Networks", IEEE Transactions on Wireless Communications, vol. 1, no. 4, Oct. 2002

[7] Anwar Sadat, Gour Karmakar and David Green,"Joint Optimization of Number and Allocation of Clusters for Wireless Sensor Networks",IEEE, 2012.

[8] XiangYang Li,"Wireless Ad Hoc and Sensor Networks",Cambridge University Press.

[9]S. Karthikeyan and S. Jayashri, "Energy Efficient System for Heterogeneous Wireless Sensor Network ", European Journal of Scientific Research ISSN 1450-216X Vol.72 No.4 (2012), pp. 599-607,Euro Journals Publishing, Inc. 2012.

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