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A Novel Intra-Cluster Communication Scheme for Improving Energy Efficiency with Variable Size

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ABSTRACT

Wireless sensor network (WSN) refers to a group of spatially distributed and dedicated sensors for observation and recording the physical conditions of the surroundings and organizing the collected information at a central location. In existing system, the GEDAR routing protocol for UWSNs. GEDAR is an any forged, geographic and timeserving routing protocol that routes information packets from device nodes to multiple sonobuoys (sinks) at the sea's surface. Once the node is in a very communication void region, GEDAR switches to the recovery mode procedure that relies on topology management through the depth adjustment of the void nodes, rather than the normal approaches victimization management messages to find and maintain routing ways on void regions. In projected system, wherever the scale of clusters is variable in order that the nearer clusters to the base station (BS) have a smaller size than farther ones. Moreover, in every cluster, victimization some intelligent fuzzy rules and in a much redistributed means, a completely unique sub tree strategy is set. During this means, some parent nodes are chosen that are liable for aggregation and aggregating information from their adjacent standard nodes and causing them to its cluster head, directly or via different parent nodes that well decreases intra-cluster communication energy prices. What is more, these 2 compatible techniques will fairly mitigate the new spot drawback ensuing from multi-hop communication with the BS. The simulations results demonstrate that the proposed protocol outperforms 2 energy-efficient protocols named DSBCA and LEACH in terms of useful network longevity for each small-scale and large-scale device networks.

Keywords : Wireless sensor network (WSN), UWSNs, Multi-Hop Communication, Multi-Layered Clustering Protocol

I. INTRODUCTION

Due to recent technological advances, the producing of little and low price sensors became technically and economically possible. The sensing physics live close conditions associated with the atmosphere encompassing the detector and remodel them into an electrical signal. Process such a proof reveals some properties concerning objects placed and/or events happening within the vicinity of the detector. An oversized variety of those disposable sensors are often networked in several applications that need unattended operations. A Wireless detector Network (WSN) contains a whole bunch or thousands of those detector nodes. These sensors have the power to speak either among one or on to an external base-station (BS). A larger variety of sensors permits for sensing over larger countries with larger accuracy. Basically, every detector node includes sensing, processing, transmission, mobilize, position finding system, and power units. An equivalent figure shows the communication design of a WSN[1-5].

Nodes have limitations in memory, process and energy; therefore it is difficult to design WSNs. Among the above-mentioned limitations, energy is the most important one because when the sensors are installed their batteries cannot be replaced or charged. Thus, energy considerations are the most prominent factors in WSNs routing. One of the most famous routing algorithms for WSNs is clustering-based hierarchical routing [8,9,10]. In this method, all nodes are divided into groups called clusters based on specific methods. In each cluster, one node is selected as a cluster head (CH) and other nodes are considered as normal nodes. Different parameters are taken into account while selecting a CH in various methods. In the major part of clustering algorithms, the main goal is to achieve uniform energy distribution to increase network lifetime. In this type of routing, sensor nodes play different roles and they may have different energy consumption according to their role. This group of methods is the best class of routing algorithms for WSNs [12,13,14].

In this paper, a multi-layered clustering algorithm is proposed where cluster sizes are variable. The size of clusters increases as the distance from the BS increases [15]. As a result in the vicinity of the BS cluster sizes are smaller than clusters, which are far from the BS. As a matter of fact, a multi-layered structure is formed where cluster sizes increase while getting farther from the BS. In each cluster, a novel structure called sub-tree topology is utilized to balance energy consumption in the whole network. In each cluster, one or more nodes (depending on size of cluster) are selected using fuzzy logic, which is called the parent. They are responsible for collecting and the compression of data from their neighboring normal nodes, which are called child nodes (CNs).

Scheme:

The proposed protocol may be a distributed and decentralized clump protocol. It acquires an acceptable structure so as to realize energy potency in each intra- and inter-cluster communications. Moreover, it overcomes the energy-hole drawback considerably that, in turn, will increase network lifespan. During this protocol, cluster size will increase whereas obtaining farther from the BS. Actually, a stratified structure is created wherever clusters near the BS are smaller than those that are farther from it. during this protocol, to pick out high-energy level nodes and correct distribution as CHs 3 criteria are thought of as well as residual energy, range of neighbornodes in neighborhood radius of the CH, that is incontestable by Ndeg and distance to the neighbor nodes. During this protocol, in every cluster a sub-tree topology is employed. As a matter of truth, every CH selects its parent nodes among volunteer parent nodes in its cluster consistent with residual energy and also the range of volunteer parent nodes within the parent radius. The choice is performed mistreatment symbolic logic. What is more, the quantity of hand-picked nodes depends on Rsize specified the larger the dimensions of cluster, it's extremely probable that additional parent nodes are hand-picked. Parent nodes are tasked with collection and aggregating knowledge from their CNS. It results in balanced distribution of energy consumption within the whole network. Besides, it decreases intra-cluster tasks in order that the CH saves additional energy. so the correct quantity of energy can be dedicated to inter-cluster communication.

Energy consumption model

For smaller distances than threshold distance d0, the free space channel model is used, otherwise the multipath fading channel model is considered. When a node sends a k-bit package to d distance, the energy consumption is computed as follows

$$E_s = \begin{cases} k*\left(E_{elec} + E_{fs}*d^2\right); & d < d_0 \\ k*\left(E_{elec} + E_{Mp}*d^4\right); & d \geq d_0 \end{cases}$$

E_{elec} is the required energy to activate the electronic circuits and depends on digital coding modulation, filtering technique, spreading of the signal and amplifier energy, E_{Mp}*d4 energy term, which depends on the distance between sender and receiver and acceptable bit-error rate, E_{fs} and E_{Mp} are required energies to send a bit in free space and multipath, respectively, d is the distance between sender and receiver and d0 is the threshold distance that is computed with the following equation

$$d = \sqrt{E_{fs} / E_{Mp}}$$

When nodes receive a k-bit package, the consumption energy is computed with the following equation

$$E_R = k * E_{elec}$$

In addition, energy for data aggregation by parent nodes and/or CH is computed with the following equation

$$E_{agg} = E_{DA} * k * n$$

n is the number of messages and EDA is the required energy to aggregate a bit.

Inter-cluster communications formation sub-phase: In this sub-phase, the data path from CH to BS is determined. Nodes whose distance from BS are less than relay-radius form, the first layer and are called send direct (SD) nodes. The nodes inside other layers are called multi-hop send (MHS) nodes. According to lines 1–10 if CH iCHi is MHS, it transmits its own aggregated data and the data received from other CHs (which are even further from the BS) to the CH which is closer to the BS. As a result, data reaches to BS step-by-step. In lines 3–5, first, the cluster head j CHj is selected among the CHs which are closer to the BS than CH i. CHj must be the closest CH to i and it would be chosen as the next hop. Otherwise in lines 6– 8, if there is a SD CH in the first layer, CH ichooses a CH among those SD ones such that the sum of energy consumption in i and the selected CH is minimized. The optimal CH is called CH optimal.

Intra-cluster formation algorithm

The next hop determination

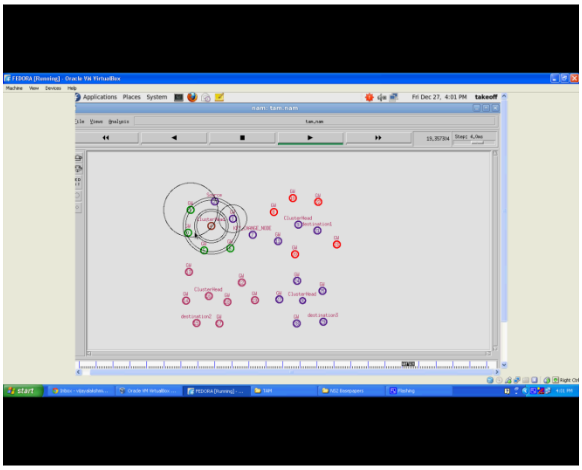
1: **If** there is no PN **then**
2: My next hop is my CH
3: **Else if** node *i* is a CN **then**
4: My next hop is the nearest PN
5: **Else if** the node *i* is PN **then**
6: **While** my next hop is not determined **do**
7: **If** $d_{(PN_j, CH)} < d_{(PN_i, CH)}$; $\forall PN_j \in S_{PN}$ **then**
8: Select my nearest PN_j
9: **If** $d_{(PN_j, CH)} < d_{(PN_i, PN_j)}$ **then**
10: Next hop for PN_i is CH
11: My next hop is determined
12: **Else**
13: Next hop for PN_i is PN_j
14: Next hop is determined
15: **End if**
16: **End if**
17: **End while**
18: **End if**

Next hop determination algorithm

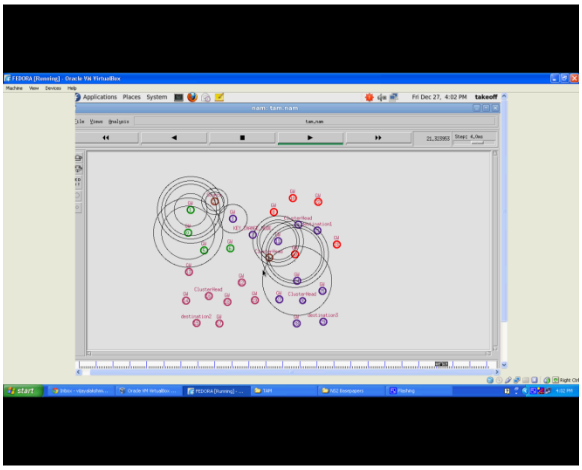
The next hop determination

1: **If** CH_i is MHS type **then**
2: **While** next hop is not determined **do**
3: **If** $d_{(CH_j, BS)} < d_{(CH_i, BS)}$; $\forall CH_j \in S_{MHS}$ **then**
4: My next hop for CH_i is my nearest CH_j
5: Next hop is determined
6: **Else if** S_{SD} is not empty **Then**
7: **My** next hop for CH_i is $CH_{optimal}$
8: Next hop is determined
9: **Else if** S_{SD} is empty Then
10: My next hop is the BS
11: Next hop is determined
12: **End if**
13: **End while**
14: **Else if** CH_i is SD type **Then**
15: Their data are sent directly to the BS
16: **End if**

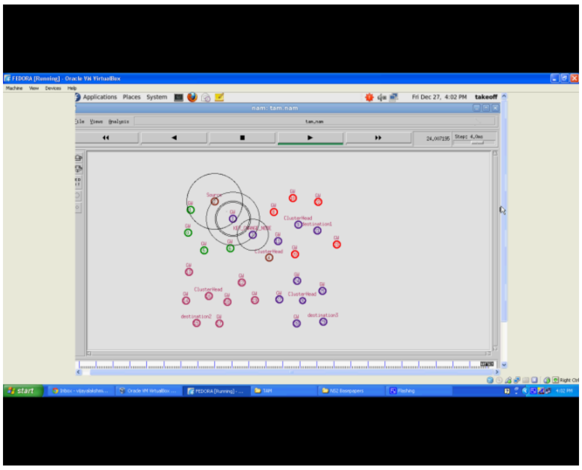
II. Results



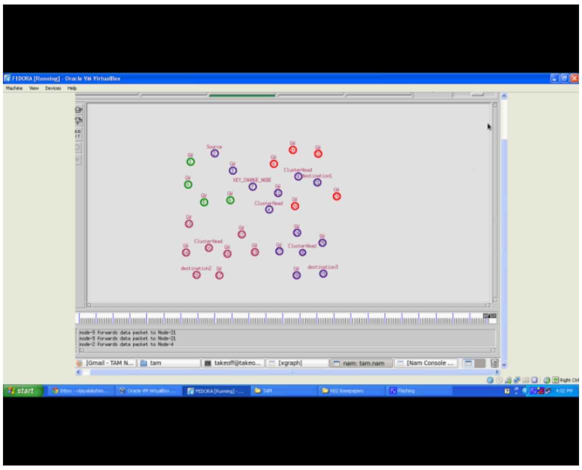
Here initially nodes will be divided into clusters based on the distance between the nodes .and the node which is having the high energy will be treated as the cluster head.



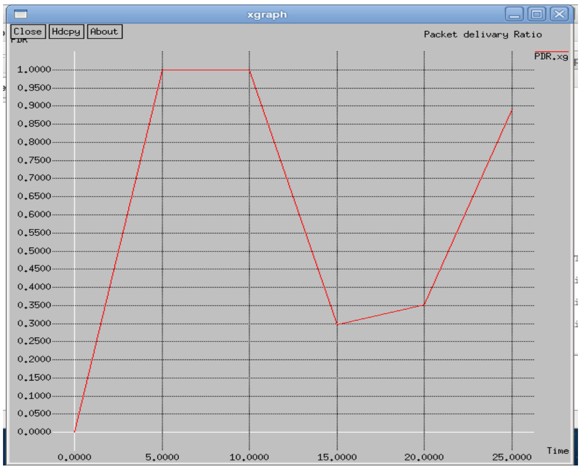
Here nodes will calculate the distances and transmit the data.



After the formation of the clusters nodes will be divided and in every cluster gateways will be presented from that gate way data will be sent to the cluster head and from cluster heads data will be sent to other clusters.



By using the multi-layered clustering protocol with variable size for the ad-hoc networks we have improved the energy efficiency and improved balanced energy consumption together.



Here we are observing the packet delivery ratio .on x axis we are taking the time value and on y axis we are taking the packet delivery ratio.

III. CONCLUSION

In this paper, a multi-layered distributed bunch protocol for ad-hoc networking with variable bunch size and additionally a uniqueintra-cluster communication theme has been planned for thesake of energy potency. Because the result incontestable, the proposedprotocol increased the network life cycle dramatically by forty eight and12% in small-scale networks and 283 and a hundred and sixtieth within the large-scalenetwork compared with LEACH and DSBCA protocols,respectively. Moreover, the planned protocol offers a farbetter distribution of the nodes leading to considerably improvedbalanced energy consumption throughout the network and Decreased risks of an instability amount. Our results show theoverall residual energy of network for the planned protocol is1.8% when the primary node is dead, whereas it's twenty one and eight forLEACH and DSBCA, severally, indicating improved loadbalancing conditions as a results of nearly higher distribution inCHs. These values are eleven, 47, and 41st for the large-scale state of affairs.

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