Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 4, Issue. 4, April 2015, pg.437 – 442

RESEARCH ARTICLE

Improved Clustering Method for Wireless Sensor Networks

Priyank M. Chauhan[1], Pranjali Doiphode[2], Chandrima Samanta[3], Farheen Akhter[4]

[1] Department of Computer Science Savitribai Phule Pune University, India

[2] Department of Computer Science Savitribai Phule Pune University, India

[3] Department of Computer Science Savitribai Phule Pune University, India

[4] Department of Computer Science Savitribai Phule Pune University, India

[1] priyank.chauhan008@gmail.com; [2] doiphodepranjali3@gmail.com;

[3] samantachandrima@gmail.com; [4] farheen.akhter9@gmail.com

Abstract— In this paper, an algorithm based on cluster head selection according to distance is proposed for improving the sensor network life time. This protocol obtains a good concert in terms of period by matching the energy capacity between all the nodes. This clustering procedure help to delay the life of wireless sensor network, especially in unfriendly environment where battery replacement of single sensor nodes is not conceivable after their distribution in the given target area. Therefore, the anticipated technique to allocate the role of the cluster head (CH) among the wireless sensor nodes in the same cluster is dynamic to increase the lifetime of the network. This algorithm uses a distance based method for providing the cluster head selection. Clustering techniques also provide good load balancing, and in-network data aggregation. In WSN, the sensor nodes have a inadequate transmission variety, and their processing and storage abilities as well as their energy resources are also restricted. Routing protocols for wireless sensor networks are responsible for keeping the routes in the network and have to guarantee dependable multi-hop communication under these conditions. In subject to throughput expansion, a linear programming based calculated formulation is carried out in which the encouraged sub problem of bandwidth allocation is explained by mixed-bias resource allocation scheme. We implement improved clustering method scheme, by changing node density and early energy of nodes in homogeneous, heterogeneous, reactive and proactive Simulation (reproduction) environments.

Keywords— Wireless Sensor Networks, Clustered Routing, Energy Efficiency, Received Signal Strength, Throughput Maximization, Linear Programming, Resource Allocation

I. INTRODUCTION

Wireless sensor network (WSN) is widely considered as one of the most significant technologies for the twenty-first century. In the past decades, it has received marvellous consideration from both academia and industry all over the world. A WSN normally contains of a large number of low-cost, low-power, and multifunctional wireless sensor nodes, with sensing, wireless communications and calculation skills. These sensor nodes interconnect over short distance via a wireless medium and collaborate to achieve a mutual task,

for example, environment monitoring, military surveillance, and industrial process control. The basic idea behind WSNs is that, while the capability of each separate sensor node is limited, the aggregate power of the complete network is appropriate for the required task.

In the given paper i.e. routing schemes to maximize the lifetime and throughput of wireless sensor networks, we have explained various methods of increasing the efficiency of a WSN by increasing its lifetime and maximizing its throughput. Energy efficiency is the future trend in information and Communication technology.

*Now basically what is WSN?

Large number of wireless sensors (nodes) collected with Base Station (BS) forms a unionized structure called WSN. In other words it refers to a group of spatially dispersed and devoted sensors for monitoring and recording the physical condition of environment and organizing the collected data at a central location. WSNs measure environmental conditions like temperature, sound pollution level, humidity, wind speed and direction, pressure etc. These sensors co-operatively pass their data through a network to a main location. The more modern networks are bi-directional and also they enable control of sensor activity. WSNs may consist of different types of nodes such as infrared, acoustic, seismic, visual, radar, thermal and many others; which extends their application range.

In direct transmission, each node interconnects with BS on distinct basis i.e., directly. Thus, detached nodes die at a faster rate as compared to closer ones. In hop-by-hop transmission, each node communicates with its nearby adjacent node which in turn transmits to its neighbour, the process remains till data reaches BS. As a result, nearer nodes consume more energy and die at a faster rate as associated to distant ones. Regarding energy effectiveness in the field of WSNs, present research body is much more involved towards clustering based routing protocols in which the nodes are ordered into clusters. Each node is responsible to interconnect with its respective CH and CHs are responsible to transport the collected information to BS. Thus, saving energy because global communication is compact due to local compression.

Unbalanced energy consumption between the nodes origins network partition and node failures, where, transmission from some nodes to the BS becomes congested. Therefore, structure of a stable backbone is one of the tasks in sensor network applications.

WSN is quiet practical. It is very easy to implement. It has the ability to work in harsh environment. It has various qualities such as troubleshooting and repair. Also it gives high level of performance. It is a well-established technology. It provides tremendous benefits to various industries. It has ability to add remote sensing points without the cost of running wires. Benefits in energy and material saving, labour saving and productivity increase. Because of all these advantages and usability's we have increased the use of WSNs in various applications. For that it will be beneficial if we increase the efficiency of WSNs.

II. INSPIRATION

About energy efficiency, many network layer protocols have been suggested. Though, these protocols are not as energy effective as needed. Initially, these protocols casually select the CHs. So the selection measure of these protocols can be enhanced in many ways. The casually selected CHs are not finest in number. The clusters thus formed demonstration variation in size i.e., the CHs of bulky sized clusters consume extra energy as related to that of the CHs of lesser sized clusters which leads to unstable energy consumption. Furthermore, each associate node, which belongs to a definite cluster, sends data to the CH even if its distance from BS is less than that from the CH. In doing so, extra energy is consumed due to which the network lifespan steps down. Then, the association mechanism of these protocols rises the total communication distance. In order to overcome the said deficiencies, new routing protocol(s) needs to be planned.

III.ROUTING PROTOCOLS USED IN THIS PAPER

Routing in wireless sensor networks varies from predictable routing in fixed networks in several ways. There is no arrangement, wireless links are changeable, sensor nodes may flop, and routing protocols have to meet firm energy saving requirements. Many routing algorithms were established for wireless networks in common. All main routing protocols planned for WSNs may be distributed into number of categories. The protocols we are using in this paper are as follows: LEACH,SEP,TEEN,DEEC.

IV. OBJECTIVE

The objective of the project is to study the wireless sensor network and implement various routing schemes to maximize:

1. Lifetime
2. Overall throughput (output).

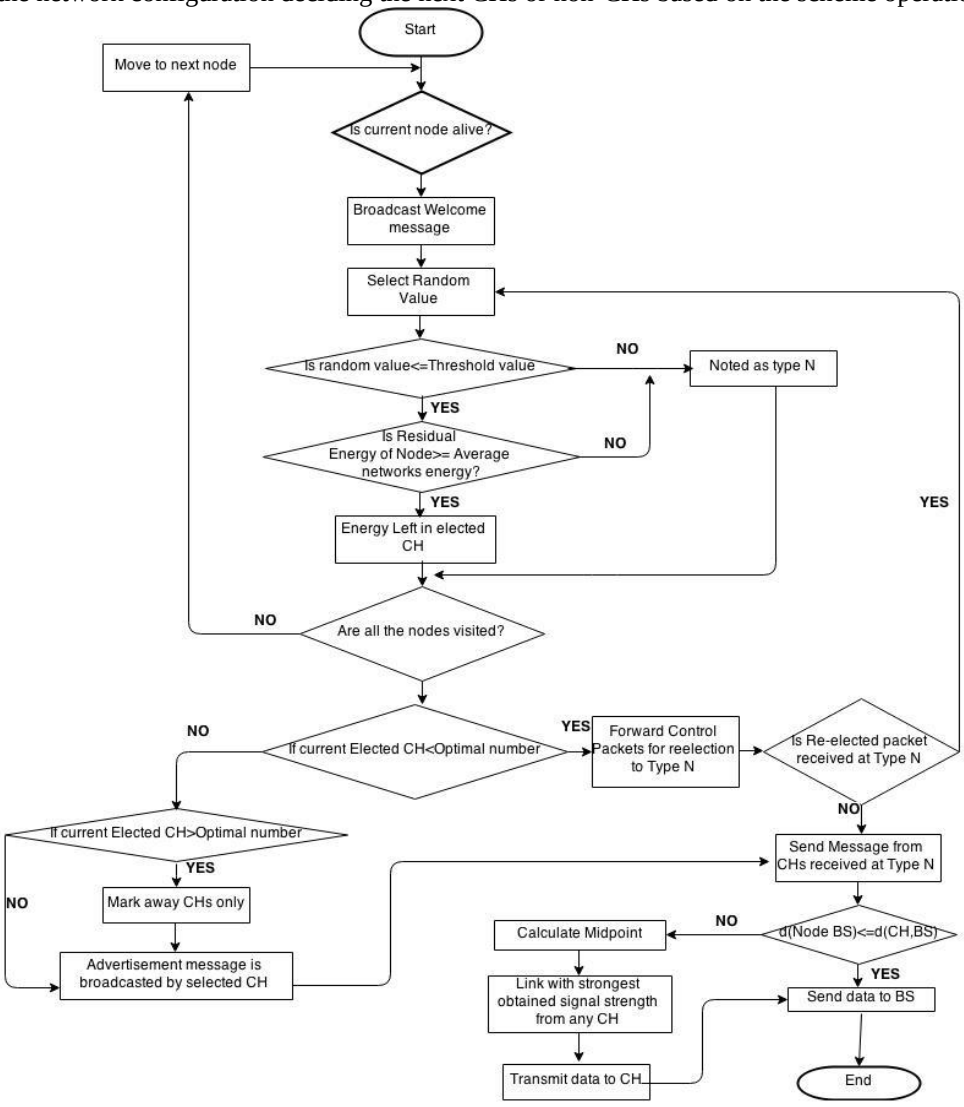
V. ASSUMPTIONS

1. To execute projected system we assume that n number of nodes are required for Homogenous Network Creation, where n should be greater than one.
2. For created nodes the threshold value of Energy and Range are predefined.

VI. PROJECTED SYSTEM

Whether it is CHs selection or association of nodes, when all the pre-requisites regarding the cluster setup are performed, the CHs receive messages from nodes intended to associate with them. Similarly, BS receives messages from CHs and nodes intended to communicate directly with it. These message receptions are followed by data scheduling, where the CHs assign Time Division Multiple Access (TDMA) schedules to their respective cluster members, and the BS then creates TDMA schedules to individual nodes and CHs, telling them when to transmit. Data transmissions, with the assumption that nodes and CHs always have data to send, begin soon after the fixed assignment of TDMA based schedules. These transmissions minimize the energy consumption due to the CHs selection and nodes association mechanisms. The radio of each node is turned off until the nodes' allocated TDMA based schedules, thus the energy consumption is further minimized.

The receiver of CH is kept on to receive all the gathered information. The CH, after receiving locally gathered data, perform signal processing functions to compress these data into a single composite signal. These high energy composite signals are then sent to the BS. When all these data transmissions end, then next round begins with the network configuration deciding the next CHs or non-CHs based on the scheme operation.



Flowchart 1 : Projected system

VII. DESIGN AND IMPLEMENTATION CONSTRAINTS

A. Implementation of improved clustering method in proactive homogeneous environment LEACH, being a routing protocol for homogenous WSNs, assumes all nodes with same initial energy. As the probability of packet drops is directly related to the number of packets sent to BS, that is why LEACH-improved clustering method performs the least in comparison the other two protocols. Thus, we conclude that our scheme extends the stability period of LEACH and LEACH-ACH.

B. Implementation of improved clustering method in reactive homogeneous environment Being the first protocol for reactive homogenous WSNs, TEEN uses hard and soft thresholds. Moreover, in the case of TEEN-improved clustering method energy of the network is further conserved by changing the association mechanism, and optimal number of CHs selection technique.

C. Implementation of improved clustering method in two level proactive heterogeneous environment SEP is a heterogeneity-aware routing protocol for WSNs.

The nodes in SEP are initially supplied with two levels of energy. Based on the lifetime of nodes and number of packet sent to BS, SEP,SEP-ACH and SEP-improved clustering method are compared respectively. In SEP, the introduction of advanced nodes helps to increase the network lifetime as well as the rate at which packets are sent to BS, and this effect is clearly reflected in. The rate at which packets are dropped is more as compared to SEP and SEPACH as illustrated in. The reason is straight forward i.e., the nature of the adopted packet drop model assumes that greater packet sending rate is directly related to the rate at which packets are dropped.

D. Implementation of improved clustering method in multi level proactive heterogeneous environment Whenever multilevel heterogeneity of nodes is in question, DEEC seems to be an appropriate choice. As CHs are one of the major sources of high energy consumption, energy is conserved in DEEC-improved clustering method because the CHs nearer than 10m are treated as normal nodes. Moreover, the communication distance is minimized by our proposed free association mechanism which facilitates high packet sending rate and longevity in the lifetime of the network. As the cluster size of each cluster is different from that of the other clusters in DEEC, so some CHs are severely contended; thereby leading to more packets being dropped. DEEC-improved clustering method solves this problem by selecting away CHs.

E. Impact of node density

The network lifetime first increases and then decreases whenever the number of nodes in LEACH, TEEN, SEP, and DEEC are varied . Initially (for less than 100 nodes), downsizing the network in terms of the number of nodes results in decreased network lifetime. This is obvious; the network area is 100m × 100m, so less number of nodes communicate at relatively greater distances thereby consuming more energy (decreased network lifetime). On the other hand up to two fold increase in node density above 100 also leads to decreased network lifetime. In this case, the network becomes congested (the cluster size increases) which means that the load on CHs is increased i.e., the CHs now forward relatively more data to BS. Thus, the CHs consume surplus energy causing the network lifetime to decrease. The proposed improved clustering method on the other hand,balances the energy consumption in cases where the number of nodes are either increased or decreased from 100. This balanced energy consumption, in case of the proposed improved clustering method, is obvious due to its adaptive approach for selecting optimal number of CHs as well as removal of back transmissions (free association).The overall efficiency order of the proposed protocols is;

DEEC-improved clustering method >SEP-improved clustering method >TEEN-improved clustering method >LEACH-improved clustering method.

The packet sending rate, at first, slowly increases then decreases and then again shows somewhat increase in case of the existing TEEN protocol. The hard and soft threshold values cause this unpredictable packet sending rate. The packet sending rate increases very slowly (with respect to the order in which the number of nodes are increased) for LEACH, SEP and DEEC, respectively. This is due to the fact that in these protocols CHs are the only responsible entities for data forwarding towards BS and incase of congested cluster size(s) the packets are slowly sent to BS. The overall efficiency order of the proposed protocols is;

TEEN-improved clustering method >LEACH-improved clustering method >SEP-improved clustering method >DEEC-improved clustering method.

Unbalanced cluster size, in the existing protocols, means that the contending nodes for channel access are increased (chances of collision are increased) thereby leading to increased packet drop rate .

This is due to the fact that in these protocols CHs are the only responsible entities for data forwarding towards BS and in case of congested cluster size(s) the packets are slowly sent to BS. Unbalanced cluster size, in the existing protocols, means that the contending nodes for channel access are increased (chances of collision are increased) thereby leading to increased packet drop rate.

Overall, the proposed protocols are efficient in the following order:

LEACH-improved clustering method >TEEN-improved clustering method >SEP-improved clustering method >DEEC-improved clustering method.

F. Impact of network lifetime (Initial energy)

When the varied network lifetime (initial energy) is plotted versus the number of successfully received packets at BS,for the newly proposed as well as the existing protocols the results are obtained by keeping constant node density (N = 100). Furthermore, these results show that packets are received at a faster rate for the newly proposed protocols as compared to the existing ones due to;

(i) balanced load on the selected CHs, and (ii) communication of individual nodes with BS. Reason for this interesting result is obvious i.e., nodes which remain alive for a longer duration transmit for a longer duration too whereas more number of contending nodes increases the chances of collisions between packets. The overall efficiency order of the proposed protocols is; TEEN-improved clustering method >LEACH-improved clustering method >SEP-improved clustering method >DEEC-improved clustering method. The relative throughput efficiency of the newly proposed protocols in comparison to their existing respective versions. Besides providing the interesting simulation discussions regarding the response of each protocol i.e., to increase network lifetime as well as throughput efficiency, these protocols have to pay some cost. Increased transmission delay for the proposed protocols as compared to their existing versions. More packet sending rate of the newly proposed protocols causes the average per packet transmission delay to increase as compared to LEACH, TEEN, SEP and DEEC, respectively.

Therefore, for achieving increased throughput and enhanced network lifetime, the proposed improved clustering method pays the cost of transmission delay.

VIII. CONCLUSIONS

One of the main challenges in the design of routing protocols for WSNs is energy efficiency due to the uncommon energy resources of sensors. The final objective behind the routing protocol design is to keep the sensors working for as long as possible, thus increasing the network lifespan. The energy consumption of the sensors is controlled by data broadcast and reception.

Therefore, routing protocols designed for WSNs should be as energy effective as possible to extend the lifespan of distinct sensors, and hence the network lifetime.

The enduring research work, with reference to network lifetime extension and throughput maximization, leads us to examine its current body. We found that many protocols are planned, however, these protocols are appropriate under detailed constraints. For example, LEACH works in practical homogeneous environment, TEEN in reactive homogeneous environment, SEP switches to two level heterogeneity, and DEEC presents multi energy levels by using an active approach. These classical protocols have a common issue i.e., the certain CHs are not optimal in number which causes non uniform load on them. Moreover, their association mechanism improves the overall length of the path used for the transmission of locally compressed data to BS.

Our projected scheme introduces natural selection of CHs mechanism, which chooses the CHs to be distant and optimal in number. Moreover, our free association mechanism decreases the overall communication distance. Thus, balanced weight on CHs and length of communication path reduction result in efficient energy utilization. More importantly, linear programming based solution for throughput enlargement with mixed bias bandwidth allocation scheme further facilitate the anticipated aims. From simulation results, we conclude that improved clustering method delays the network lifespan and maximizes the throughput of homogeneous, heterogeneous, proactive and reactive protocols in all of the selected node densities and as well network lifespans (initial energies).

ACKNOWLEDGEMENT

I have great pleasure and satisfaction in presenting this Routing Scheme to Maximize lifetime of Wireless Sensor Networks. I take this opportunity to express my sincere thanks to all those people who have helped me to complete this dissertation successfully.

I would like to express my deepest gratitude to my Project guide Prof. Manisha S. Bhende, Prof. Pramod Patil HOD (Comp. Dept.). It has been a great honor to work under them. They have provided me with inspiration both professionally and personally during the course of my degree. The completion of this dissertation would not have been possible without their encouragement, patience guidance and constant support.

I would also like to extend my sincere thanks to Principal Dr. R. K. Jain for her help and support in all respects. My thanks also go to my friends and colleagues for their kind and noble support. I thank all those

unseen people across the Internet for maintaining those valuable documents and resources on the internet which helped me in the preparation of the report.

I am forever indebted to my family members for their constant support and encouragement throughout the past years.

I also acknowledge the research work done by all the researchers in this field.

REFERENCES

[1] A. Ahmad, N. Javaid, Z. A. Khan, U. Qasim, T. A. Alghamdi" improved clustering method: Routing Scheme to Maximize Lifetime
and Throughput of Wireless Sensor Networks" Citation information: DOI 10.1109/JSEN.2014.2328613, IEEE Sensors Journal

[2] K. Akkaya and M. Younis, "A survey on routing protocols for wireless sensor networks," Ad hoc networks, vol. 3, no. 3, pp. 325–349, 2005.

[3] I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, "Wireless sensor networks: a survey," Computer networks, vol. 38, no. 4, pp. 393– 422, 2002.

[4] S. Zeadally, S. U. Khan, and N. Chilamkurti, "Energy-efficient networking: past, present, and future," The Journal of Supercomputing, vol. 62, no. 3, pp. 1093–1118, 2012.

[5] N. A. Pantazis, S. A. Nikolidakis, and D. D. Vergados, "Energyefficient routing protocols in wireless sensor networks: A survey," Communications Surveys & Tutorials, IEEE, vol. 15, no. 2, pp. 551–591, 2013.

[6] S. Saleh, M. Ahmed, B. M. Ali, M. F. A. Rasid, and A. Ismail, "A survey on energy awareness mechanisms in routing protocols for wireless sensor networks using optimization methods," Transactions on Emerging Telecommunications Technologies, 2013.

[7] M. Radi, B. Dezfouli, K. A. Bakar, and M. Lee, "Multipath routing in wireless sensor networks: Survey and research challenges," Sensors, vol. 12, no. 1, pp. 650–685, 2012.

