International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 02 Issue: 04 | July-2015 www.irjet.net p-ISSN: 2395-0072

Reduced Rate of Energy Consumption in WSN With Dual Cluster Heads

[1]Neelam Ojha, [2]Dr. Kanika Sharma

[1]M.Tech Student, [2]Assistant Professor
[1,2]NITTTR, Chandigarh

Abstract: Wireless sensor network finds its constraint on the battery sources. Once the nodes are deployed, the feasibility in the replacement of battery seems impossible to exist. All efforts are directed in making the sensor network running for longer duration of time. This has led to the development of various routing protocols aiming to achieve enhanced network lifetime. These routing protocols come under the different categories of routing techniques. Hierarchical routing has proven its significance in various research works being done for network lifetime enhancement. In this paper, Unequal clustering protocols have been brought into limelight. Unequal clustering meant to remove Hot Spot Problem existing in the multi hop scenario. UCMR is the protocol which has performed very well in handling the efficient cluster head selection. Because of unequal clustering there is still a scope of bringing out the energy balancing in the network which seems to be missing in the UCMR protocol. Introducing double cluster heads in the each cluster would divide the load on the cluster head and it would be shared by the vice cluster head in the same cluster. This approach gives the maximum output and with much reduced rate of energy consumption in the network. Comparative analysis with the UCMR and LEACH protocol signifies that UCMR outperforms the other two in rate of energy consumption.

Keywords: Wireless Sensor Network (WSN), UCMR (Unequal Clustering Multi Hop routing protocol), UCR (Unequal Clustering Routing)

I. Introduction to Wireless Sensor Network

i. Introduction & Applications of WSN

Wireless sensor network (WSN) consists of various small number of nodes deployed in the network randomly but uniformly to collect data from all the nodes and thereby forwarding it to the Base Station. The development of WSN has been inspired from the battlefield surveillance applications. Military applications seek that sensor deployment to monitor the activities of the intruder in the prohibited areas. Since the successful applicability of WSN in the military areas it has opened up the scope for various applications, whether it be an environmental applications to detect the forest fire detection in the forest or it be habitat monitoring to study various movements of different types of animals/ birds breeds and their introspection of their behavior in adverse circumstances.
WSN also makes a huge impact in the monitoring the lifetime of the structural buildings which makes it possible to determine the catastrophe at much earlier stage. Vibration sensors give the alarm signal when value of vibration exceeds the threshold value which is being already a fixed value. This is how further actions can be taken to overcome such situations.

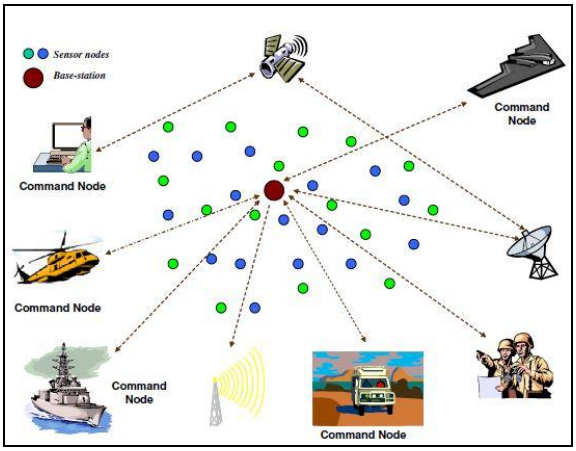

Fig.1 WSN Military Application Scenario [1]

Apart from these applications, Medical applications are also explored in the same prospective. Various sensors might be installed in the body of the person to study the various activities of internal organs. This helps the doctor to keep track of patients during his treatment.

ii. Architecture of WSN

The basic architecture of WSN consists of various nodes deployed in the large monitoring area where they connect themselves and start transmitting data to the Base station, once Base Station initialize the network by its initializing message. Once the sensor network collects data, it then forwards the data after removing the redundant data to the Base Station or Sink.
The data collected at the sink is then forwarded to the user via internet as shown in the Fig. 2

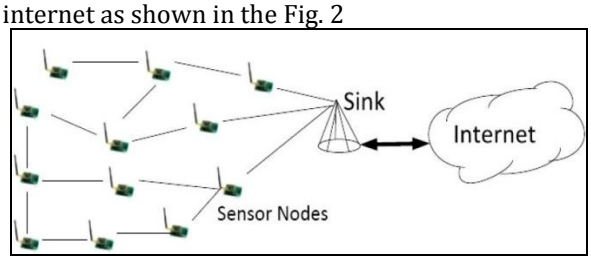

Fig.2 Architecture of Wireless Sensor Network [2]

iii. Sensor Node Components

The components of sensor nodes are shown in the Fig. It consists of four main units like Sensing unit, Processing unit, Transceiver unit and Power unit. They may also have application dependent additional components such as a location finding system, a power generator and a Mobilizer. Sensing units are usually made up of two subunits: Sensors, Analog to Digital Converters (ADCs). The analog signals generated by the sensors based on the observed phenomenon are converted to digital signals by the ADC, and then signals fed into the processing unit.
Each sensor node has processing capability. Processing is done by one or more microcontrollers, CPU or DSP chip.

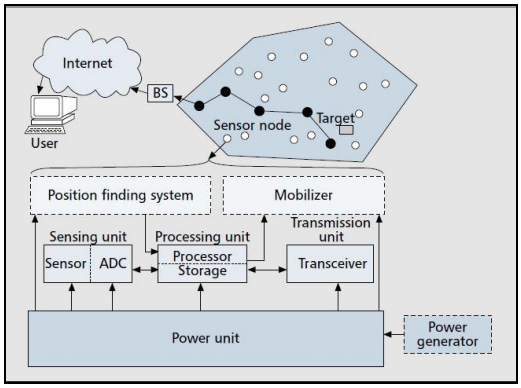

Fig.3 Components of Sensor Node [2]

The rest of the paper is organized as: section 2 covers the routing in WSN, section 3 covers the introduction to unequal clustering and section 4 covered by the proposed protocol with conclusion in section 5. Then the references are covered.

II. Routing in WSN

Routing is one of the most important part in the WSN. It is the one of the provisional aspect which gives the opportunity to the user to handle the communication cost of routing the data packets by efficiently managing the routes between the nodes.
There are various types of routing which are classified as shown in the diagram:
The details of these routing protocols can be studied from the [3-4].
In our paper, the work is being focused on the hierarchical network routing protocol in which the clustering is being considered as shown in the Fig. In this clustering topology the cluster head acts as the data collecting node and then it forwards the collected data to the Base Station.

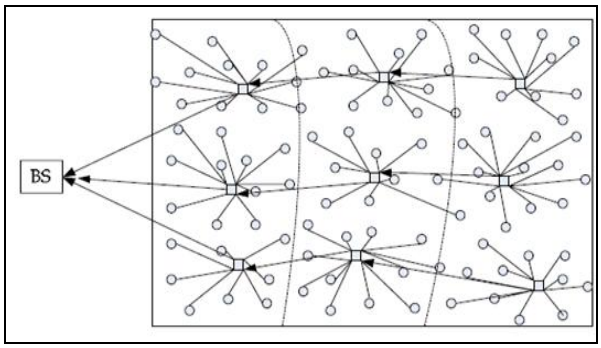

Fig. 4 Clustering in WSN [4]

Equal clustering in the multi hop scenario would deplete the energy of nodes nearby to the Base Station. This problem is termed as Hot Sport Problem. To deal with this, unequal clustering is being introduces.

III. Unequal clustering in WSN

In the unequal clustering protocol, clusters are of unequal size. There are two types of unequal clustering protocols. While dealing with the clustering protocols, size of clusters really makes a huge impact on the energy balancing in the network. Earlier there use to be same size clusters, when the Base Station use to be at the center of the network. That scenario of network would not have created any

problem with the same size. When the Base Station is located outside the network the multi hop transmission takes place. This multi hop transmission would put a lot of burden on the nodes which are cluster heads and are nearby to the Base Station. As they are supposed to relay a lot of data coming from the other clusters present in the network. So with equal sized clusters the energy consumption of the clusters relaying the data gets on the higher side and it leads to the early die of those clusters [5].

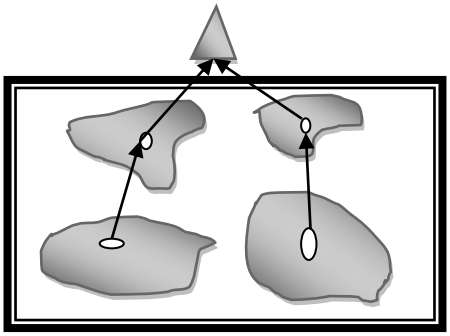

Fig.5 Unequal Clustering in UCR

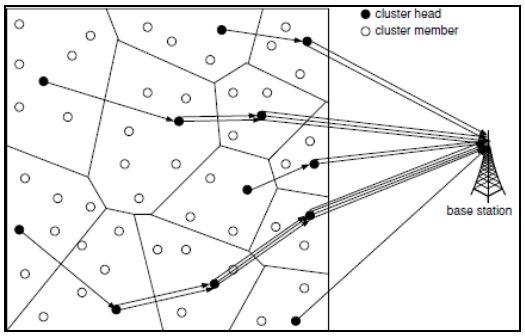

Fig.6 UCMR protocol [6]

UCMR is unequally clustered multi-hop routing protocol. In this algorithm each cluster has a different cluster size based on its distance with reference to the base station. In the case of inter-cluster communication, this algorithm uses shortest path algorithm to find out nearest node, so that it can save energy. In this selection of cluster-head is based on remaining energy, node degree and distance from the centroid. It is the simple multi-hop transmission which provides balanced energy consumption among cluster-heads. The multi-hop transmission in this protocol can improve QoS parameters like error rate and data rate. It means UCMR enhances the lifetime of network. Simulation result shows that UCMR extends the network lifetime by 40% over UCR and 75% over Leach protocol [7].

IV. Proposed Protocol D-UCMR

The proposed protocol based on Dual Cluster head is D-UCMR. It introduces the Main Cluster Head and Vice cluster Head in the same cluster. MCH collects data from the VCH and VCH collects data from all the nodes in the cluster. The rate of energy consumption can be seen in the Fig.7

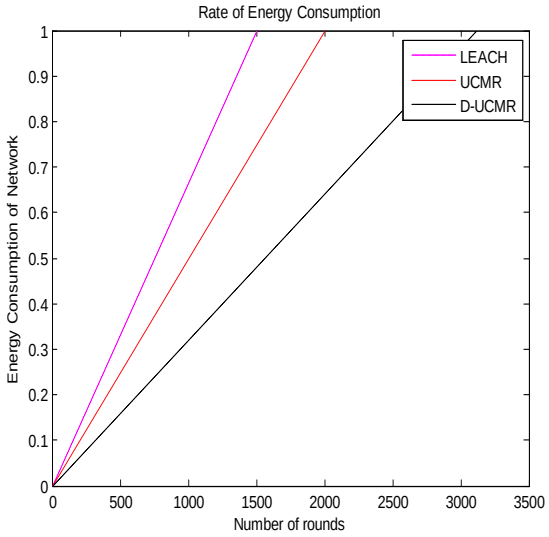

Fig. 7 Comparison of rate of energy consumption of the protocols

It is due to the fact that introducing the two cluster heads reduces the solely energy consumption of cluster head. This lead to the efficient use of energy of nodes thereby reducing the rate of energy consumption of nodes. The proposed protocol covers more than 3000 rounds before devouring its full energy which was nearly 2000 rounds in case of UCMR.

V. Conclusion

Wireless Sensor Network has been very promising in the sensing technology giving scope to the various opportunities that tend to facilitate human beings in various ways. Clustering does not only provide scalability in the network, but it also brings the load balancing in the network. In this paper, UCMR is being modified with the approach of double cluster heads in the each cluster for data transmission. As a result it can be seen the rate of energy consumption is reduced at much further level as compare to UCMR and LEACH protocol. This is because of the reason that loads balancing and energy balancing is

achieved by reducing the load on the single cluster head. As, all the nodes have 1 Joule of initial energy, this total energy is consumed after covering 3100 number of rounds where as it was just 2000 in case of UCMR. This shows the promising performance of the proposed technique.

References

[1] Ameer Ahmed Abbasi, Mohamed Younis, "A survey on clustering algorithms for wireless sensor networks, "Elsevier, Computer Communications, Vol.30, pp.2826–2841, 2007.

[2] Jamal N. Al-Karaki, Ahmed E. Kamal,"Routing Techniques in Wireless Sensor Networks: A Survey,"IEEE Wireless Communications, pp.6-28, 2004.

[3] Deepak Goyal, Malay Ranjan Tripathy, "Routing Protocol in Wireless Sensor Networks: A Survey", IEEE International Conference on Advanced Computing & Communication Technologies, pp. 474-480, 2012.

[4] Neha Rathi, Jyoti Saraswat, Partha Pratim Bhattacharya, "A review on routing protocols for application in Wireless Sensor Networks", International Journal of Distributed and Parallel Systems (IJDPS), Vol.3, No.5, pp. 39-58, 2012.

[5] Chengfa Li, Mao Ye, Guihai Chen and Jie Wu, "An Energy-Efficient Unequal Clustering Mechanism for Wireless Sensor Networks", IEEE International Conference on Mobile Adhoc and Sensor Systems Conference, pp. ,2005.

[6] U.Hari, B.Ramachandran, Chris Johnson, "An unequally clustered multihop routing protocol for wireless sensor networks", IEEE Conference on Advances in Computing Communication & Informatics (ICACCI), pp. 1007-1011, 2013.

[7] W. Heinzelman, J. Kulik, and H. Balakrishnan, "Adaptive Protocols for Information Dissemination in Wireless Sensor Networks," Proc. 5th ACM/IEEE Mobicom, Seattle, WA, pp. 174–85, Aug. 1999.

