

Sectoring-based Algorithm for Congestion Control in Wireless Sensor Networks

Tejas Ambekar
Department of computer
Engineering,
JSPM's Jayawantrao Sawant
College of Engineering, Pune

Aditya Mishra
Department of computer
Engineering,
JSPM's Jayawantrao Sawant
College of Engineering, Pune,

Dipak Pawar
Department of computer
Engineering,
JSPM's Jayawantrao Sawant
College of Engineering, Pune,

Dattatray Waghore
Department of computer Engineering,
JSPM's Jayawantrao Sawant College of Engineering,
Pune,

Aachal Gawai
Department of computer Engineering,
JSPM's Jayawantrao Sawant College of Engineering,
Pune,

Abstract— Wireless Sensor Networks(WSN) consists, a large group of sensor node connected through a wireless medium. It offers an innovative expertise that has unprecedented ability to monitor the physical world precisely. Because of resource-oriented nature of sensor nodes, they add up to the problems that have emerged, out of which reliability is an important property. To improve the reliability of each sensor node, the proposed sectoring algorithm divides the area to be sensed into sectors. Each sector has a sector head which is most nearest node to the sink node. It is observed that selection of sector head is assumed as insignificant in past work of research. However, in this paper, reliability is observed by different QoS parameters..

Keywords—WSN- Wireless Sensor Network, Sectoring, QoS, Quality of Service..

I. INTRODUCTION

Wireless Sensor Network (WSN) is the collection sensor nodes (small) that sense environment according to their property and route that sensed processed data to based station. Wireless sensor network is network of isolated and organized systems they are dependent on total no of these less costly tiny devices which are main part of managing memory processing routing and communication between other sensor nodes. Sensors are spread over given area pass their information to system which is called sink node. WSNs are used in wide range of real time problems which includes not only major sectors like commercial applications, Industrial applications or healthcare applications but also minor sectors like home automation object tracking fire detection. The biggest problem in wireless sensor networks is transport of valid data between the sensor-node and between nodes and sink and thus congestion control is most important part which effectively increase the percentage of reliable data delivery in WSN

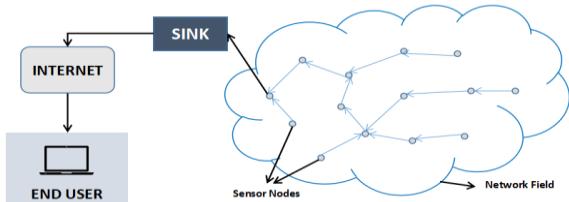


Fig 1:- Basic Architecture of WSN

II. QOS PROPERTIES

Packet Delivery Ratio (PDR) => The ratio of received number of packet and generated number of packet.
Routing Overhead => It is nothing but overhead occurring in handshaking for routing the data.
Delay / Latency => The delay is also referred as latency. The time required in transmission of data packet from the source node to sink node called latency/delay.
Consumption of Energy => Consumption of energy is the total consumed energy by the network.
Through-put => The number of packet processed by the node/time. It is usually measured in bits/sec.
Packet Loss Ratio => It is the ratio which represents the number of lost packet to total number of sent-packet-ratio.

III. LITERATURE SURVEY

Grid - Based Method[4], a method that uses multi path routing protocol with a vision to reduce the congestion and support QoS traffic in Wireless Sensor Network. Grid Methodology technically follows certain behaviour of dividing network into squared shaped grid and of predefined size. It follows multi path protocol because it has multiple paths to get the data to the sink(destination) node. Grid Method can be considered in two ways, one dividing network into grids to make diagonal paths to make data reach sink node and second that density of nodes used for decision making of data forwarding. All the data is collected within the grid by the master node and then passed using multi path routing protocol to the sink with multi-hop.

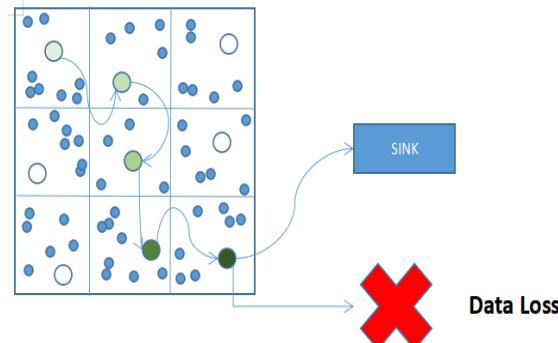


Fig 2 :- Grid-Based topology Architecture

Advantages of Grid Based Method are data collection in grid is as efficient as in any other method proposed before and this could also lead to data forwarding to sink node from master node but with less density of nodes in the network field. Selection of master node is easy within a grid with an advantage of multiple path so there should not be any dependency. Disadvantages of Grid Based Method are inter-Grid communication can create a problem when number of nodes are more. If network field has large number of nodes then data loss can be seen at Master Nodes near to Sink. Data loss can lead to decrement in Packet Delivery Ratio. Increasing Packet Loss Ratio.

In tree-based clustering [15], the network area is divided into multiple clusters and a node is selected from each cluster that holds the information of every nodes in that cluster. The selected node is called cluster head. The cluster head link's cost using the node's information, and a least cost route between the sink and every nodes is selected using Dijkstra's algorithm. Every node that has children is identified after evaluation of every node by the cluster head. A routing table is created for each cluster node after every node's children is determined and the best route is selected. From the routing table a record is considered for the selection of best route.

The advantages of Tree-based clustering are Energy Efficiency, an optimal route generation using Dijkstra's algorithm and effective in route generation. The disadvantages are the nodes closer to sink acquire more energy if the density of nodes increases and creates energy-hole problem, less robust, the best route is not always the one having the least cost, the neighbor node has higher probability of being selected for data transfer even if it is highly congested, increasing Packet drop and packet loss ratio.

In chain based routing protocol [16], multiple chains of sensor nodes are created in the direction of sink it is an alternative to clustering based protocol. In this protocol very first node of each chain created during formation of chain sends data to the node closest in same chain and like this the process is repeated until data reaches last node of that chain. At the end of the process this last node aggregates and transmits data to the sink node chain based algorithm is improvisation of process where chain of all lead nodes is created and the node which is nearest to sink aggregates data from all these lead nodes and then transmit it to sink and then for next transmission of data at the end node which is having highest residual energy will perform this task.

Advantages of chain based routing is it consumes very less energy and which is why it is energy efficient and protocol effectively extends wsn's lifetime. Disadvantages of this protocol are in every transmission of data leader node of main chain steadily gets congested, high delay is also one of biggest disadvantage and in chain based protocol data redundancy possibility increases abruptly.

IV. PROPOSED WORK

In the sectoring algorithm, at first we divide the network field is divided into small sectors. Then further in the network, each of the sector having different nodes which is in range of sink node becomes eligible for next election of

the sector head. Now depending on the parameters like remaining energy of the nodes, distance of node from the sink node/destination node, etc. Next sector head is elected. Here in the proposed algorithm the major issue of congestion control which is inter communication in the previous techniques are overcome here. Now according to algorithm no two nodes from two different sector can communicate with each other so avoiding data loss. So now unnecessary interruption of unwanted nodes between the sectors are avoided which interms results in fast delivery of packets. In proposed algorithm neither of the inter-sector communication between two sector heads in the network and two normal nodes of different sector are allowed so their is issue of heavy data passing from one of the head to other which previously created issue of delay and data loss.

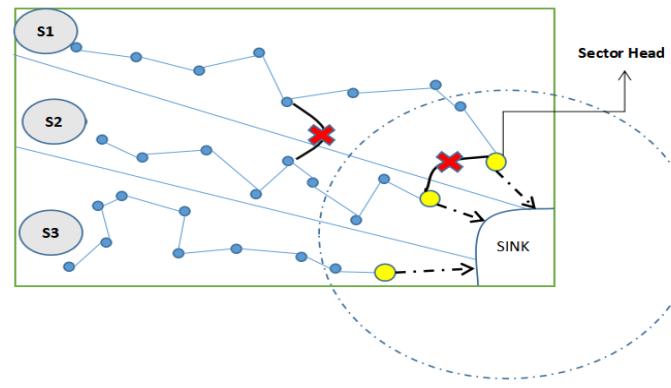


Fig 3 :- Congestion Control using sectoring technique

In the fig above you can see three sectors namely S1, S2, S3. Each sector consists of some number of nodes which are represented by blue dots in fig above. As already known, no two nodes can communicate if belong to different sectors (shown with a red cross between blue dots). Below in the network field in the bottom, sink/destination node is placed with a wide range. Node from each sector selected as sector head represented by yellow dots. No two sector heads can communicate. And only sector head of that sector could pass the data to the sink as shown.

V. CONCLUSION

We have analyzed different techniques (Clustering, Grid based) to avoid congestion in Wireless Sensor Networks. The approaches divide the total number of sensor nodes into different clusters, grids with suitable strategies. Each phase of the approach has its own strategy to transmit data packets from one node to another. The proposed sectoring algorithm is inclined to overcome some of the disadvantages of existing clustering schemes.

VI. REFERENCES

- [1] Wategaonkar D.N. and Deshpande V.S. (2013) "MARS: Sectoring Scheme to Improve Reliability in WSN", International Journal of Wireless Communication. ISSN: 2231-3559 & E-ISSN: 2231-3567, Volume 3, Issue 1, 2013, pp.-47-50.
- [2] Narayan Wategaonkar, Dhanashri ; Nagaraj, S. V., "Analysis of QoS Parameters using Prediction Algorithms on CSO-based Energy-Efficient Reliable Sectoring Scheme in WSN", Journal of Physics: Conference Series, Volume 1911, Issue 1, article id. 012024 (2021).
- [3] Gaganpreet Kaur, "Comparative Analysis of Clustering and Chain Based Routing Protocols for Wireless Sensor Networks: A

Review", International Journal of Advanced Science and Technology, Vol. 29 No. 8s (2020): Vol. 29 No. 8s (2020).

[4] Omar Banimelhem, Samer Khasawneh, GMCAR: Grid-based multipath with congestion avoidance routing protocol in wireless sensor networks, Ad Hoc Networks, Volume 10, Issue 7, 2012, Pages 1346-1361.

[5] M. Asif, S. Khan, R. Ahmad, M. Sohail, and D. Singh, "Quality of Service of Routing Protocols in Wireless Sensor Networks: A Review", IEEE Access (vol. 5) 2017, pp 1846-1871.

[6] Yan G., Yucheng S., Han H., Tong Y. International Conference on Wireless Communications and Signal Processing, Nanjing, 2, 1-6.

[7] G. M. Shafiullah, A. Gyasi-Agyei, P. J Wolfs 2008 A Survey of Energy – Efficient and QoS – Aware Routing Protocols for Wireless Sensor Networks Novel Algorithms and Techniques in Telecommunications Automation and Industrial Electronics, pp. 352-357.

[8] Martinez, J.-F et al. Modelling 2007 QoS for Wireless Sensor Networks in IFIP International Federation for Information Processing (Boston: Springer vol 248) pp. 143-154.

[9] Zhan-Bo S., Yuan-ming W. International Conference on Apperceiving Computing and Intelligence Analysis, Chengdu, 3, 26-30.

[10] Sunil K., Zhenhua F., Fei H., Yang X. Journal Wireless Communications & Mobile Computing, 9(10), 1301-1311.

[11] S. H. Kang and T. Nguyen 2012 Distance-Based Thresholds for Cluster Head Selection in Wireless Sensor Networks in IEEE Communications Letters, vol. 16(9) pp. 1396-1399.

[12] Isik M.T., Ozgur B.A. IEEE Journal of Communications Magazine, USA, 47(8), 92-99.

[13] Md. Abdur Rahman, Abdulmotaleb E.S., Wail G. Advanced Trends in Sensor Network, Verlag, 21, 221-245.

[14] Mamun, Quazi 2012 A qualitative comparison of different logical topologies for wireless sensor networks Sensors vol. 12(11), pp. 14887—14913.

[15] Amir hossein, Mohajerzadeh, Mohammah-H Yaghmaee, Zahra Eskandari, "Tree based energy efficient and Congestion aware Routing Protocol for Wireless Sensor Networks", Communication Systems, 2008. ICCS 2008. 11th IEEE Singapore International Conference.

[16] Hadjila, Mourad & Guyennet, Herve & Feham, Mohammed. (2013). A Chain-Based Routing Protocol to Maximize the Lifetime of Wireless Sensor Networks. Wireless Sensor Network. 05. 116-120. 10.4236/wsn.2013.55014.

[17] Pantziou," Clustering in Wireless Sensor Networks", Zhang/RFID and Sensor Networks AU7777_C012 Page Proof Page 324 2009-6-24.