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An Analysis Of Lifetime Improvement Techniques In Wireless Sensor Networks

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ABSTRACT

Wireless sensor networks are used to monitor physical or environmental conditions like temperature, pressure, sound, etc. Increasing the lifetime of wireless sensor networks is a major challenge since the nodes are equipped with limited battery power and is not easy to replace or recharge the battery energy, when the nodes die. Energy efficient routing helps in increasing the lifetime of sensor nodes by maximizing the overall performance of the nodes. Usually best path is chosen for transmission of data packets from source to destination in routing algorithm, but if the same path is used for a long period of time for the fast transmission time the energy of nodes in the selected path will get drained fast. This paper discussed about different method used for increasing the lifetime of wireless sensor network.

Keywords:- Wireless Sensor Networks, Sensor Node, Routing Method, Network Lifetime.

I. INTRODUCTION

Wireless sensor networks are collections of compact size and relatively inexpensive computational nodes called sensor nodes that measure local environmental conditions or other parameters and report such information to the base station for appropriate processing. The basic unit of a sensor network is a sensor node. The sensor nodes in the wireless sensor networks can perform various operations such as sense the physical or environmental conditions, communicate with other sensor nodes and can also perform basic computations on the data being sensed. Modern developments in sensor technology and wireless communication have helped in the deployment of large scale wireless sensor networks for a variety of applications including environmental monitoring of habitation, data collection of high temperature, pressure, sound, moisture, illumination, shuddering etc. For such type of applications hundreds or thousands of low cost sensor nodes can be deployed over the area to be monitored. In a data gathering sensor network, each sensor node must sporadically forward its sensed data back to a node called, sink node or base station.

In general sensor nodes are powered by small, inexpensive batteries, charging batteries for sensor nodes is often difficult. Consequently, energy consumption should be managed in an efficient way to maximize the post deployment network lifetime. If there is the distance is too far between the sensor node and sink node in the network, transmission is not energy efficient because the transmission power is directly proportional to the square or quadruple of the transmission distance. Instead of sensor to sink direct transmission multihop routing is performed for long distance as more battery energy could be saved. But multihop routing cause frequent use of the sensor nodes near to the sink node and makes those sensor nodes run out of energy rapidly. Hence unbalanced energy consumption [11] is a major problem in direct transmission and also with multihop routing schemes.

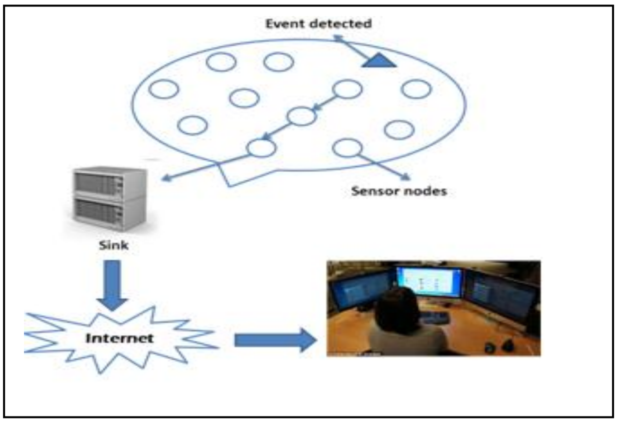

Fig.1.Sensor network architecture

It can cause early fail of the sensor network due to the failure of some critical nodes, which results in a significant drop of network lifetime. Each sensor node forward its monitored data back to the sink without any relay node or intermediate node in direct transmission mode and this mode helps in avoiding the relay burden for the nodes which is close to the sink. Each sensor node forwards its monitored data to its next level hop neighbors in hop by hop transmission mode and this helps in reducing the burden of long distance transmission for nodes distant away from the sink. Therefore, even energy consumption between all nodes can be obtained through suitably allocating the amount of data transmitted in the two transmission modes. In [13] Wu et al. proposed an energy cost function, it takes an account into initial energy, residual energy and the necessary transmission energy along the path. In [6] Jongseok Park and Sartaj Sahni proposed a modified bellman ford algorithm path with minimum cost is preferred from all available paths in an iterative manner. In [7] a clustering routing method a different battery energy level is assigned to the sensor nodes. There is an improvement in the performance than to the uniform level battery distribution. This paper discusses on the various methods used for improving the network lifetime. Energy aware sink relocation method is discussed in Section II. Balancing energy consumption method is discussed in Section III and a-star algorithm and fuzzy approach are discussed in section IV. In section V paper is concluded.

II. ENERGY AWARE SINK RELOCATION METHOD

In a wireless sensor network sensor nodes have limited battery energy. In order to improve the lifetime of wireless sensor network, battery energy of each sensor node has to be conserved. Hence, Sensor nodes after performing sensing, it will deliver the monitored data to the sink via multihopping, significantly; nodes near to the sink will consume more battery power than others. For this reason these nodes will quickly drain out their battery energy and reduce the lifetime of the sensor network. Sink relocation is a competent method for enhancing the lifetime of the sensor network. Energy aware sink relocation method (EASR) is used here. A relocatable sink can improve the lifetime of the network by avoiding remaining at a certain location for a long time, which may reduce the lifetime of nearby sensor nodes. The sink relocation method has two components. The first component is to find out whether to trigger the sink relocation by determining whether a relocation condition is met or not. The second component determines which direction sink is heading in and the relocation distance. For relocation, condition sink periodically collect the information about the residual battery energy of each sensor node in the wireless sensor network.

Maximum capacity path (MCP) routing protocol is used to find the maximum capacity path with respect to residual energy of each sensor neighbor of the sink node, after collecting the information. For each maximum capacity path maximum capacity value is determined in the network. Sink relocation employs when the maximum capacity value falls below a threshold value. The sink relocation method considers the residual battery energy of the sensor node and then drives the sink to a location with a huge amount of residual energy compared to other nodes. The maximum capacity routing algorithm has three steps. First is layering the graph into a layered network, second is determining the maximum capacity path for each node, the third is routing is performed and updating of residual battery energy. In this energy aware sink relocation method the transmission range of each sensor node is adjusted according to the residual battery energy. Energy aware sink relocation has two components, (i) energy aware transmission range adjusting and (ii) sink relocation method. If a sensor node has a larger transmission range, then its number of neighbors will be more, its drawback is the long distance transmission will consume more battery energy of the sensor node. If the range of the node is less it doesn't help too much routing and it can conserve the residual battery energy. A node with more residual battery energy can use a large transmission range to reduce the routing path. On the other hand a sensor node with small residual battery energy can adjust its transmission range to be small to save its battery energy. Hence the adjustable transmission mechanism can increase the lifetime of a sensor node and so the lifetime of the network. Sink relocation occurs when the residual battery energy of the nearby sensor node of the sink becomes less than the threshold value and sink will relocate to a new location which can enlarge the network lifetime.

III. BALANCED ENERGY CONSUMPTIONMETHOD

In wireless sensor network unbalanced energy consumption is a natural difficulty which can minimize the network lifetime. Corona based network separation and diverse routing approaches are coupled with data aggregation technique. In data gathering sensor network each sensor node occasionally senses the data from the environment and sends it back to the sink node. Sensor nodes are power-driven by small, inexpensive battery, therefore energy utilization must be managed effectively to enlarge the network lifetime. Fully localized zone based routing is engaged. Coronas are subdivided into zones. Finest number of coronas are advantageous to exploit the network lifetime is computed. The network is separated into coronas centered on the sink with equivalent width. All nodes use the similar likelihood for direct transmission and hop by hop transmission.

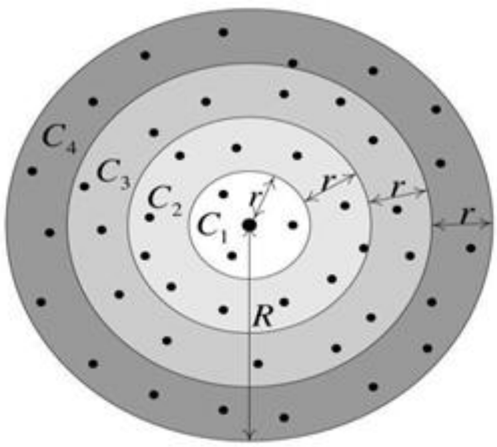

Fig.2.Illustration of network division

The energy utilization, balancing is separated into intra corona energy utilization, balancing and inter corona energy utilization balancing. In intra corona energy utilization, balancing each corona is separated to uniformly distribute the amount of data received by nodes in each corona. In inter corona energy utilization balancing amount of data for direct transmission and hop by hop transmission is separated optimally. Balanced energy utilization is obtained by optimally distributing the amount of data for hop by hop and direct transmission at each node. All nodes in the same corona employ same transmission range for direct transmission and same transmission range for hop by hop transmission. Each corona is divided into sub coronas and each sub corona is further divided into zones in zone based routing. For nodes near to the sink direct transmission is favored. When energy utilization is balanced all nodes have same energy utilization.

IV. A-STAR ALGORITHM AND FUZZY APPROACH

This technique determines a best possible routing path from source to destination with maximum residual battery power, least number of hops and smallest traffic loads. A mixture of fuzzy approach and a-star algorithm is employed. Commonly in routing algorithm finest path is chosen for transmission of data from source to destination. Although, if the same path is used for an extended period of time for fast transmission time the nodes in the chosen path will get drained quick. The best possible routing path is intended by the base station and broadcasts it the nodes in the network. All the sensor nodes are scattered randomly and they have the same highest transmission range.

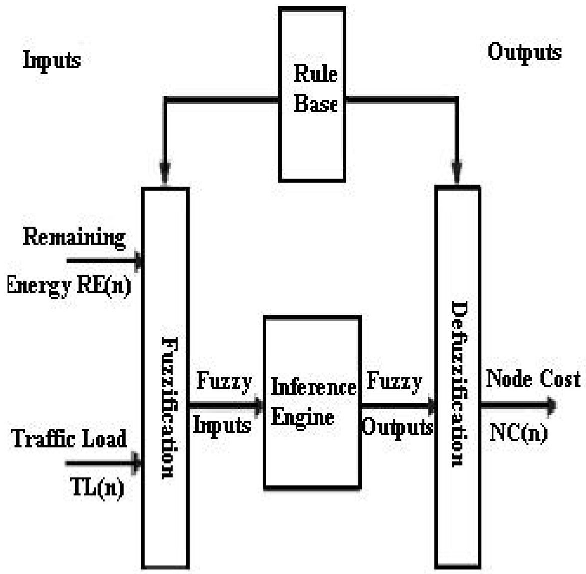

Fig.3.Fuzzy structure with two inputs and one output

The dynamic activities of a system are defined by a set of fuzzy rules based on the facts of a human expert. These rules are of the general form if (antecedent) then (consequent). Antecedents of a fuzzy rule use logic operations to figure a grouping of fuzzy sets. The hearts of a fuzzy system are the rules. It is provided by human experts .It can be extracted from numerical data as well. The rules can be expressed as a group of if then statements. Antecedents of a fuzzy rule will form the input fuzzy space and similarly consequents of a fuzzy rule from the output fuzzy space. The four components of a fuzzy system are relevance, falsification, defuzzification, inferenceengine. In fuzzification crisp inputs are compared to their fuzzy illustration. Wih this membership functions like gaussian, triangular, trapezoidal are concerned. In the inference engine the fuzzified inputs are mapped to the rule base to make fuzzy output. In defuzzification the output of a fuzzy rule is mapped to crisp output.

A. A-star algorithm

A-star algorithm is a competent algorithm for finding low cost path. It is one of the finest search algorithms. It uses an evaluation function defined as f (n) =g (n) +h (n) (1)
Where g (n) is real cost from the start node to the node n and h (n) is the estimated cost of the optimal path from node n to the destination node. A-star algorithm has two lists specifically open list and closed list. Open list is a priority queue and nodes are arranged based on the value of the evaluation function. Closed list contains the list of nodes that has already been examined. In the beginning the open list contains the start node and after first iteration it takes peak of the priority list and checks whether it is the destination node. If it's not the destination node subsequently it finds the evaluation function of all neighboring nodes and adds it to the open list. It determines the path with lowest possible cost. It constructs a tree structure to explore the optimal path from a node to the base station. The evaluation function is mentioned as followed by,
f (n) =c(n)+(1/M(n)) (2)
Where c(n) is the cost of the node n, it is calculated using fuzzy approach. Fuzzy approach takes into account residual energy and traffic load of node n. M (n) is the shortest distance from the node n to the base station. In the fuzzy approach the fuzzified values are found by the inference engine. The inference engine consists of rule base. Since rule base is a series of if then rules. The fuzzy implication operator employed is and this technique of increasing network lifespan is highly resourceful.

V. CONCLUSION

This paper discussed about the various techniques for improving the lifetime of the wireless sensor network. Unbalanced energy utilization is a vital crisis in the sensor networks which is characterized by multihop routing and many to one pattern of the traffic. In sink relocation method (EASR) when the residual battery energy of the nearby sensor node of the sink becomes less than a threshold value then sink will relocate to a new location which can enlarge the network lifetime and too lifetime of sensor nodes. For determining the best possible routing path from source to destination fuzzy approach and a-star algorithm are combined. Optimal routing path is established by considering the maximum remaining power in battery with least number of hops and without overhead of traffic loads. This scheme outperforms the other two schemes as in this case it determines the optimal path by consideration residual battery energy, traffic load of the each sensor node and shortest distance from the source node to the sink node.

REFERENCES

[1] K.Akkaya and M.Younis,"A survey of routing protocols in wireless sensor networks",*Ad Hoc networks*,vol.3,no.3,pp 325-349,may 2005

[2] J.N Alkaraki,A.E Kamal,"Routing techniques in Wireless sensor networks a survey",*IEEE wirelss Communication*,vol.11,no.6.pp.6-28, Dec 2004

[3] S.Y Chiang and J.L Wang," Routing analysis Fuzzy logic systems in wireless sensor networks" *IEEE transactions*,vol.11,no.2.pp 2-26,Oct 2011 [4] C Hua and T.P Yum,"Optimal routing and data aggregation for maximizing the lifetime of wireless sensor network", *IEEE ACM* , vol 16 no.4,pp 892-903,Aug 2008

[5] Imad S Alshawi,Lianshan Yan,Wei Pan.Bin Luo "Lifetime Enhancement in wireless sensor netwo Rk using fuzzy approach and a-star algorithm", *IEEE Sensors journal*,vol.12,October 2012

[6] Jongseok Park and Sartaj Sahni,"An online Heuristic for maximum lifetime routing in wireless Sensor network",*IEEETransactions* , vol.55,no.8, Aug 2006

[7] Junlin li,Ghassan Alkegib,"Network lifetime Maximization for estimation in mulhop wire less sensor network."*IEEE Transactions*,vol. 57,no.7,july 2009

[8] Kobi Cohen and Amir Leshem,"A time varying Opportunistic approach to lifetime maximization Of wireless sensor networks", *IEEE Transactions* vol.58,no.10,October 2010.

[9] K. M. Rana and M. A. Zaveri, "ASEER: A routing method to extend life of two-tiered wireless sensor network," *International Journal of Advanced Smart Sensor network* system vol 11,no.2,pp 1-16,Oct.2011.

[10] Ritesh Madan,Shuguang Cui,Sanjay Lall,"Cross layer design for lifetime maximization in wireless sensor network" *IEEE Transactions*,vol.5, no.11 Nov 2006

[11] H. RKarkvandi, E. Pecht, and O.Yadid,"Effective Lifetime aware routing in wireless sensor netwo-rks ",*IEEE Sensors journal*,vol 11,no 12,pp. 3359-3367,Dec 2011.

[12] Dr Sami Halawani, Abdul Waheed Khan," Sensor enhancement techniques in wireless sensor networks" *Journal of computing*,vol.2,may 2011

[13] C.Wu,R.Yuan,H.Zhou,"A novel load balanced And lifetime maximization routing protocol in wireless sensor network", *IEEE transactions*,vol 3 pp. 305-314