Energy Efficient Scheme for improving the performance of Wireless Sensor Networks

Bhupinderjeet Singh[1], Gurpreet Singh[2]

[1] (MTech CSE Student, Gurukul vidyapeeth institute of Engineering and technology, Banur ,India)

[2] (Assistant Professor CSE, Gurukul vidyapeeth institute of Engineering and technology, Banur ,India)

ABSTRACT:

The wireless sensor networks sensing the neighbor nodes to disseminated the information to every sensor nodes on the networks area. The random walk through topology is mentioning in this paper for obtaining the results of the sensor networks. The NS2 simulator has been using for deploying the sensor networks and importing 802.15.4 module. The purpose of this module in wireless sensor networks for consuming less power and increase the throughput of the WSNs networks. The proposed Algorithm is using in this paper for tackle the link failure problems with Ad Hoc on demand distance vector routing (AODV) protocol. The RREQ and RREP messages delivered on the sensor networks for filling the routing table information. Each information updated when a sensor node communicates with the destination node. The Euclidean edge length also counted in this paper to sort every sensor node so that the node knows the position of the neighbor node and the distance between the two nodes not more than several meters.

Keywords: WSN, AODV, Throughput, Reserve Energy, Topology, Power.

Introduction

A wireless sensor networks (WSNs) will be upcoming technology that influences the performance of other Ad Hoc network approaches. This technology employs low cost, less complexity, high flexibility and act as a simple node that consumes less power than other ordinary nodes used in other technologies. The sensor nodes are characterized particularly by their limited power and memory capacities. The power is used to be a key parameter for any approach supposing that sensor nodes' batteries are unchangeable and not rechargeable. The power would influence the reliability of the network, if the residual battery of an important node, as a cluster head, is limited. Respecting the residual battery of the node leads to a more efficient routing path, cluster head designation, aggregation point selection, etc [14]. The limited memory is also a very important parameter as it defines the size of the operating system and the processing code.Wireless sensor nodes employ many nodes that had created multiple route paths participated in multi-hop communication. The number of protocols had been acted on different layers to be covered in wireless sensor networks for inclusive in communication. The sensor nodes can be deployed in random manner so that each sensor nodes sensing other neighbor sensor nodes for communicating with data payload. The distance between each sensor node is few meters so that nodes able to communicate without any physical disturbance. The figure 1.1 illustrated the working of wireless sensor nodes.

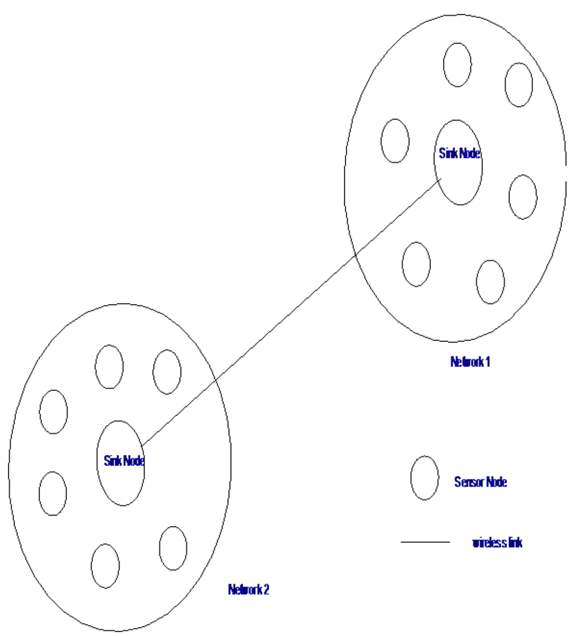

Fig. 1.1: Deployment of Wireless sensor Nodes.

When the sensor nodes will be start communicating then the sensor doesn't stumble with each other and they are working in a cluster manner that randomly walkthrough with each other. The sensor nodes has affected when they out of range. Each sensor nodes are eminence with each other when they come in the range and transferring the data. The sink node refuge the other sensing nodes in one cluster network and does not communicate until the permission of the sink node. The sink node of network1 is able to communicating with the other sink node of netwok2. Thus the sensor nodes of network1 and network2 are communicating with each other with prior knowledge of sink nodes.

1.1 Applications of Wireless Sensor Networks [8]

a) Military Applications: The rapid deployment, self-organization and fault-tolerance characteristics of sensor networks make them a very promising sensing technique for military. Since sensor networks are based on the dense deployment of disposable and low-cost sensor nodes, destruction of some nodes by hostile action does not affect a military operation as much as the destruction of a traditional sensor.
b) Environmental Applications: some environmental applications of sensor networks include tracking the movements of species, i.e. habitat monitoring, monitoring environmental conditions that affect crops and livestock, irrigation, macro instruments for large-scale Earth monitoring.
c) Commercial applications: there are many potential and emerging commercial WSN applications such as inventory management, product quality monitoring, smart offices, patient and elderly monitoring, material fatigue monitoring and environmental control in office buildings.

1.2 Features of Wireless Sensor Networks [8]

a) Power Consumption: The sensor nodes consume less power than any AdHoc network. The Sensor node has been acting as a sleep mode; it means the mode is turned on when there is no more transmission. When the sensor nodes transferring the data to other nodes then the sensing mode turned off and this way the power consumption is less.

b) Topological Changes: The sensor nodes likely to be working in statically manner. These sensor nodes is able to communicating with other nodes when changes in topology. It is also possible to have sensor networks with highly mobile nodes. Sensor network topologies may be prone to more frequent changes than conventional ad hoc networks.

c) Scalability: The sensor nodes are deploying on the simulating area and it scalable with other sensor nodes. The number of sensor node tied with sink node and it is up to the sink node whether to attach with other network or not. All schemes developed for sensor networks have to be scalable enough to cope with the node densities and numbers, which are higher than all other types of network in terms of orders of magnitude.

2. Related Work

The energy consumption [1] that effectively uses energy metric that evaluate a specific path incorporates the cost of using the path, the energy health of the nodes along the path, the lifecycle of the nodes and topology of the network. The protocol optimizes the use of scattered AC and energy scavenging motes in the network. The Proposed technique reserve the energy vs time and incorporates the proactive protocol and simulated in Prowler.

The approach [2] proposed a profiler for calculating the energy estimation. The authors had calculated the consumed energy at different activities such as listening, routing, sending and sleeping since 2011. The authors also explained the energy leakage problem and The sensor is supposed to spend the same amount of energy whenever it senses. Hence, sensing in terms of power is considered as an atomic operation, which is automatically reported to the power logger.

The sensor nodes are deploying [11] in wireless sensor network area using NS2 Simulator. The AODV protocol has been using in this paper by providing information to sensor nodes over the sensor area. This paper avoiding the problem of multipath and generates alarm when any unauthenticated node enters. This paper calculates throughput and delay of the sensor network.

3. Proposed Algorithm

Our algorithm also adapts to topology changes by monitoring the activity of the neighbors. If the next hop on the path is unreachable, an unsolicited RREP with a new sequence number is propagated through the upstream of the break. We modify the route discovery process to incorporate multiple routes such that when a node receives another copy of RREQ from the same source, it will check the routing table as follows:

1. If the new RREQ has a smaller hop count, it updates the route entry as original AODV does.

2. If it equals to the one in route table, the node simply adds a new route

The Detail of Proposed Algorithm is shown in figure 1.2:

1. The Proposed Algorithm provides information to the destination node by using reverse path of RREP.

2. The temporary Link establish between each sensor nodes let us say l1,l2…..ln.

3. Each link is temporary assigned if it is broken between source to destination node then hop comes in between them.

4. The sink node Sn monitors all the traffic and all sensor nodes connected with this sensor node.

For each sensor node i receives RREQ packet to the sensor node j then
2: Distance: =Distance (j, i);
3: Forward RREP on the reverse path
4: Store information about the node sending Route Reply (RREP) in the Routing Table (RT)
5: Set the Round Trip Time (RTT) when the packet is forwarded
6: Node i updates RT to each neighbor node n
7: Sort all links E in non- decreasing order of the Euclidean edge length. Let L1, L2, · · ·, Lm be the sorted list of m wireless links.
8: If (the link was broken in i to j)
8.1: Select the shortest path p then
8.2: Set the next hop nearest to node j
9: Sink Node S_n monitors the n nodes and competes for the links.
10: S_n listen any announcement, it updates packets to each node locally.
End For

Fig. 1.2: Proposed Algorithm

4. Simulation Results

Simulations are a feasible way to test and evaluate wireless applications, such as sensor networks. With simulations, the critical properties and behavior of the network, and the impact on the application can be analyzed. In the simulation scenario 100 nodes, which use IEEE 802.15.4 module, were randomly positioned on a grid. The source-destination pairs are randomly selected and each source generates Constant Bit Rate (CBR) traffic flows with the given packet rate (packets/second). AODV only one route is established which means that a new route-finding procedure is initiated in case of congestion. The following input parameters shown in table 1.

Table 1: Simulation Parameters of WSN Networks

Parameter	Value
Number of Sensors	100
Sensor Area	800 m x 800 m
Routing Protocol	AODV
Transmission Range	20 m
Simulation time	70s
Sensor Module	802.15.4
Protocol	AODV

4.1 Throughput of WSN Networks

The throughput propagates the total received packets divided by the total send packets generated by the source node. The throughput achieved in this wireless sensor networks is approximately 44 Mbps i.e. remarkable. It shows the losses of the packet at most negligible. From the figure 1.3; some congestion or interference in the sensor node 40 and rest of all the nodes contributes his job at high end.

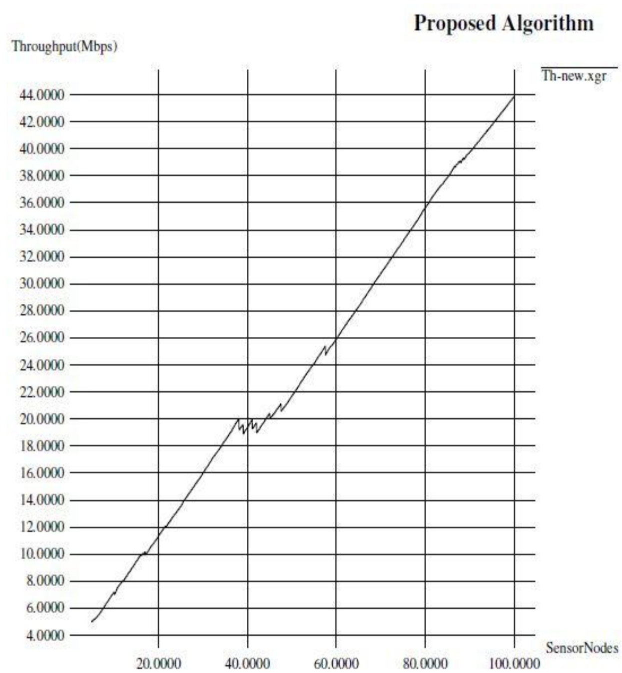

Fig. 1.3: Throughput of Wireless sensor Nodes.

4.2 Energy Reserve of WSN Networks

To calculate the reserved energy from ns2 simulator is:

$$P_r(d) = \frac{P_t G_t G_r \lambda^2}{(4\prod)2d^2L} \quad (1)$$

The received power only depends on the transmitted power Pt, the antenna's gains (Gs and Gr), and on the distance between the sender and the receiver. It accounts mainly for the fact that a radio wave which moves away from the sender has to cover a larger area. So the received power decreases with the square of the distance. In this formula L is an additional loss factor independent of the propagation.

$$P_r(d) = \frac{P_t G_t G_r h_t h_r}{d^4} \quad (2)$$

The two-ray ground model assumes that the received energy is the sum of the direct line of sight path and the path including one reflection on the ground between the sender and the receiver. The received power becomes independent of the frequency of the transmitted signal but depends on the height of the transmitter (ht) and receiver (hr).

If the distance between two nodes is smaller than a threshold tm, then the equation (1) is used, the two-ray ground model otherwise.

$$tm = \frac{4\prod hthr}{\lambda} \quad (3)$$

Keeping in view of the equation 1, 2 and 3, the following graph has been generating using ns2 simulator and shown in figure 1.4. The total energy reserved is 3%.

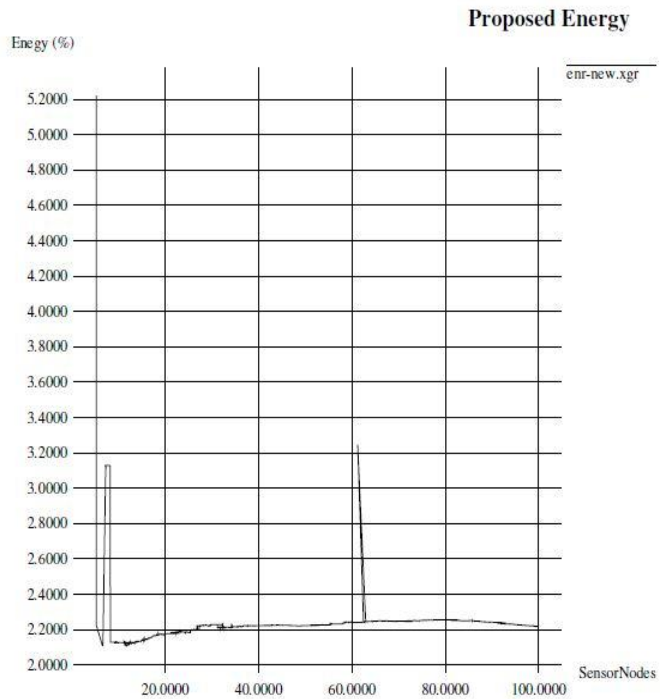

Fig. 1.4: Energy Reserve of Wireless sensor Nodes.

5. Conclusion

Each component used in the wireless sensor networks has strong influence on the network topology. The topology had shown in random walk through and share routing table information to each neighbor sensor node. The proposed algorithm had used AODV protocol for choosing shortest path and stored routing table information. The previous approaches [1] face the problem of link failure that is smartly handled by our proposed algorithm. The Throughput and reserve energy calculated from this paper and it observes that the performance of wireless sensor networks improves.

References

[1] Hanh-Phuc Le, Mervin John, Kris Pister," Energy-Aware Routing in Wireless Sensor Networks with Adaptive Energy-Slope Control",EE290Q-2 Spring",2009.

[2] Javier Moreno Molina,Jan Haase,Christoph Grimm," Energy Consumption Estimation and Profiling in Wireless Sensor Networks",IJCT,2011.

[3] Masato Noto, "An Efficient Flooding Method in Ad-hoc Networks for Reducing Power Consumption ", IEEE 2008; pp. 974-979.

[4] S.Koteswararao, Dr. M. Sailaja, P. Ramesh, E. Nageswararao, V. Rajesh "Sensor Networks Simulation In Ns2.26" IJEST, vol2, 2011, pp.251-254.

[5] Chris Heegard et al., High-performance wireless ethernet, IEEE Commun., v. 39, n. 11, November 2001, pp. 64–73.
[6] Jaap C. Haartsen and Sven Mattisson, Bluetooth a new low-power radio interface providing short-range connectivity, Proc. IEEE, v. 88, n. 10, October 2000, pp. 1651–1661.
[7] The Network Simulator -ns-2. http://www.isi.edu/nsnam/ns/
[8] Erdal cayirci, Chunming Rong, "Security in wireless Ad Hoc and Sensor Networks", John Wiley and Sons, 2009.
[9] Perkins, C., Belding-Royer, E., and Das, S. (2003). Rfc 3561 - ad hoc on-demand distance vector (AODV) routing.
[10] Akyildiz, I. F., Su, W., Sankarasubramaniam, Y., and Cyirci, E. "Wireless sensor networks: A survey. Computer Networks",2002, pp.393–422.
[11] Parminder Singh, Damandeep Kaur, "An Approach to Improve the Performance of WSN during Wormhole Attack using Promiscuous Mode",IJCA,2013, pp. 26-29.