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Design of Real-time Self Establish Wireless Sensor For Dynamic Network

Gowtham[1]
[1]SNS College of Engineering, ECE,
gowthamece34@gmail.com

Dr.P.Gnanasundari[2]
[2]SNS College of Engineering, ECE,
sundaribalakrishna@yahoo.co.in

Abstract— Wireless sensor network in the recent trend engaged with high speed responsive real time system. This type of real time system requires reliable and compatible sensor to work in an environment where the sensor is dynamic in nature. Sensor network is to design to perform a set of high level information processing tasks such as detection, tracking or classification. Application of sensor networks is wide ranging and can vary significantly in application requirements, modes of deployment, sensing modality, power supply. Dynamic configuring of wireless sensor involves timing constraints to configure the sensor or to switch an adaptive sensor when working node failure due to energy, data rate, packet loss and range of the sensor. So the network, with such dynamic nature needs a background sensor which is able to be switched when the active sensor has a problem and improper functioning due to the network deploy environment. The background sensor lies inactive inside the range of the active sensor; ensure that the sensor is about to die and make sure the last data transfer successful find delay time to switch. Fault tolerance is achieved by switching the background sensor with the active sensor, where the background sensor self establish themselves in the network and perform similar routing metrics and configure them self with the network as soon they are switched. Once, the actual sensor retained back to the active condition then the background sensor will go to inactive state during this switching process the sensor will not loss data packet..

Index Terms—Switching,Dynamic,Network,Background,Delay

1 Introduction

THe Wireless sensor networks are the recent trend to measure and acquisition of large data from varying sensor which are installed in the environment, industrial, manufacturing or might be in any area that need to monitor and control.wireless sensor size are being compressed in order to place them in a compact and intact to measure the parameter.Birth of tiny embedded processor with low power which also constitute less energy to make the work done.

In this paper, we first describe a self establishment for dynamic sensor wireless network, which are deployed in the worst environment. Modelling of the sensor network for worst case environment where the deployment is a difficult and failure rate of the sensor is high. This paper gives detail report on the throughput, packet loss, packet delivery ratio and delay for switching. Dynamic configuring a background sensor to the active sensor required small interval this interval is chosen from the outset of sensor parameter such as an end to end delay, packet loss and retransmission energy drain below threshold.

2 DESIGN

2.1 Characteristics of Wireless Sensor Network

The main characteristics of a WSN include: Power consumption constraints for nodes using batteries or energy harvesting Ability to cope with node failures (resilience), mobility of nodes, heterogeneity of nodes, scalability to the large scale of deployment, ability to withstand uncertain environmental conditions, ease of use, cross-layer design. However, for a dynamic sensor network power consumption of the sensor during switching will be high and scalability of such network is difficult and the proportional behavior will differ when the number of nodes is increased. But, it can support any type of worst case environment where the sensor can be deployed and able to withstand the environmental condition in spite of their heterogeneity of nodes.

2.2 Background of Routing Protocol

Wireless sensor is intended to be used as an mobile sensor node with their own feasible path to determine the data has be fetch and delivered in optimistic manner.but using static network routing for a dynamic mobile sensor node will decrease the efficiency of packet forwarding from one node to other which collectively increase the packet loss.so it is necessary to incorpate the sensor with a dynamic routing protocol which automatically update the route value in table and maintain the route priority so as to reach the network manager for controlling.so,DYSW (Dynamic Switching Protocol) is similar to AODV but provided with switching mechanism and thereby follow constrains in real time and self establishment routing constraints.

2.3 Routing Constrain

The systems are incorporated with real time controller to perform all routing metrics and enable fast configuration of dynamic sensor deployed and obey the following constraints:

a) Switching to be performed when the delay exists between the data from the sensor.
b) Switching can be performed when the sensor is the lack of more energy or it's about to die.
c) Switching can be performed when the packet loss is more.

The delay is one most prominent parameter in the real time system.the statical method of replacement requires the entire system to be shut down until the replacement has been completed.So, the first constrain means that the sensor last optimistic condition is maintained so as the controller will not alarm, but notify the failure.once,it reaches the optimistic condition the sensor is replaced within the hold time.the hold time calculated based on the compactness and also in coporation of the sensor.

2.4 Dynamic Sensor Model

The mobile node is distributed in the field which are placed with the predefined location to each other as in[1]. Each node as the move the rotation and magnitude are updated to the controller and the distance also determined through RFID tag which are placed in the registered location for fast identification of node.The registered position are determined through the number of path ways junction.When a node initially joins the network, the node connects to a network controller of the network and is authenticated by the unique IDs which are assigned during the deployment and no other sensor is allowed to enter the network which does not have unique id as shown in Fig-1. After that the node configured and connects to the sink.

Each active node has background sensors which are adopted with sleep and awake protocol. During the proper functioning of the sensor this background sensor is in sleep and wait for their call form the active sensor. Once when the active sensor is failure or improper function the background sensor is called to undertake the physical measurement and wait for a while until the last data to reach the sink as in [2].

The real-time signal processors sense the change of the sensor through the unique id and authenticate the background to start processing.

Again the active sensor is back and starts establishing a search mechanism to find its background to switch and replace with the same constraints as specified in the routing constraints. So, it's ability to switch under real time without stopping the current execution of the system.

2.5 Best Feasible Selection

In Best feasible sensor it requires knowledge of the sensor value in order to determine the sensor to use. However, this serves as a ground truth (in one-step optimization) for comparison with the other criteria:

$$\tilde{l} = \arg_{j \in (1,2,,N)-U} \int_{\gamma_\beta} d\mathbf{x} \quad \textbf{(1)}$$

From equation (1), an argument value of sensor nodes and the range is differentiated to find the best feasible sensor.

3 Simulation

3.1 Delays for Switching

In real-time t the processor clock indicates time C (t), which may or may not be the same as t. So, for perfect hardware clock, the derivative Dc(t)/dt should be equal to 1. There will be a minor change, however, occur so always consider the drift, which is also called as **skew**.

The clock skew can actually change over time due to environmental conditions, such as temperature, pressure, humidity, but assume it stays close to 1, so that

$$1-\rho \leq dC(t)/dt \leq 1+\rho \quad \textbf{(2)}$$

Where ρ denotes the maximum skew. A typical value of ρ of the hardware is 10^{-6} seconds. The exists a small fluctuations on the skew are usually modeled as random noise. The skew is maintained close to 1 so that the system has appropriate time to switch the real-time sensor during the delays. When the value is close to 1, then the delay will be less as in Table-2.

The latency in the system is divided into four components of time:

Send time: The time taken by the sink to construct the message, including delays introduced by operating system calls, context switching and data access to the network interface.

Access time: The delay incurred while waiting for the Access to the transmission channel due to contention, collisions and other transmission delays.

Propagation time: The time for the message to travel across the channel to the destination. It can be highly variable, from negligible for single-hop wireless transmission to very long in multi-hop wide-area transmissions.

Receiving time: The time for the network interface on the receiver side to get the message and notify the host of its arrival. This delay can be kept small by time-stamping the incoming packet in the network as in [10].

TABLE I
SWITCHING DELAY

No of Nodes	AODV	DYSW
20	75.023	23.5788
40	76.044	26.0407
60	77.094	27.8077
80	77.801	24.9054
100	78.149	25.9467

However the sending time delay from the sink is determined and can be calculated with respect to time. Similarly the receiving time delay is considered for the self establishment of the sensor. From Fig-2, the propagation and access time delay is less predictable and can be determined only after the traffic or congestion of the channel is released. Propagation delay may be small or large based on the traffic. When they are large the delay are used to switch the sensor while the access time delay cannot take into account for switching this may be lead to partial data loss or create node failure. So, the access time is not considered for the establishment of the sensor.

3.2 Throughput

Throughput is the number of packets, delivered between peer to peer node.So, the throughput is fixed to near to unity during switching because the delay while switching can be precise and finite valued.The AODV protocol throughput will be differ based on the network traffic.DYS protocol maintains a unified traffic for the particular node and its adjacent nodes.

Obviously, the network has better throughput provided less channel traffic and congestion of the particular network. From Table-2, the data rate of the network differs based on the flow of data and the protocol on the channel. The channel is path exist for transferring data between the node,the throughput can be increase by shortest path selection.The node as soon as the packet is reach the node check for the appropriate address in the routing table if matches it direct the packet or else it will transmit to next node to find the appropriate shortest route towards the destination.The response message are transmitted from node to network manager in the same fashion.

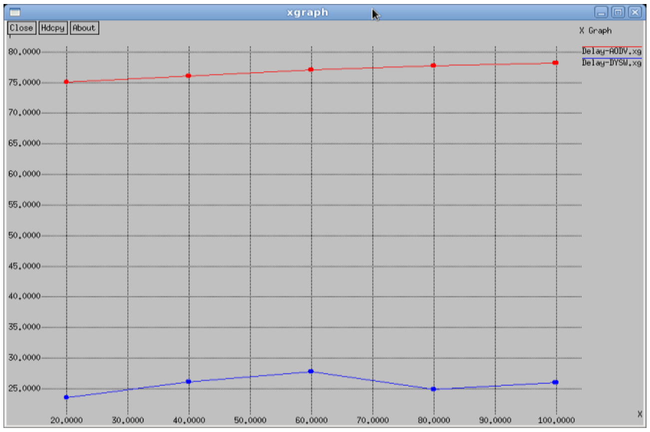

Fig. 1. Dynamic sensor switching delay

TABLE II
THROUGHPUT DURING SWITCHING

No of Nodes	AODV	DYSW
20	**0.15**	**0.81**
40	**0.16**	**0.92**
60	**0.09**	**0.97**
80	**0.07**	**0.91**
100	**0.12**	**0.87**

For dynamic switching network node requires that it might have a closed uniform throughput during switching, so that the sensor data which has been sent or receive is performed successfully and wait to finish the last packet to be transmitted. From Fig-3, the number of sensors has increased the throughput during switching get decrease, this is due to throughput is considered for switching. When the number of nodes is less or high the throughput will be less due to their delays. When delay has increased the throughput will be more. These behaviors ensure that the delay and throughput are data dependent parameters.

3.3 Packet Loss

Packet loss is the failure of one or more transmitted packets to arrive at their destination.The packet loss is almost similar with another protocol. Since it's based on the size and the traffic on the network.The packet loss is considered for a large number of sensor, but for sensor of small group the packet loss is average of 0.9471 for 20 nodes.

In dynamic network transport protocols, the packets ratio has steadily increased so, this protocol can be implemented with less number of sensors. However, after switching to new node it will work similar to the AODV. The sensor switching for a large number of sensor node will cause packet loss for each node. So, it can be made, it cluster head configuration to reduce the effect of packet loss.In,sensor cluster head node,each associate a small group based on the local routing protocol and elect a sensor to be a head based on the energy which should possess more than a threshold and draining of energy should be less than the other node.The choice of choosing Sensor head with less activity on measurement. The distance between the head and the end node should keep minimum as possible.The second order of the sensor under the cluster is not allowed.

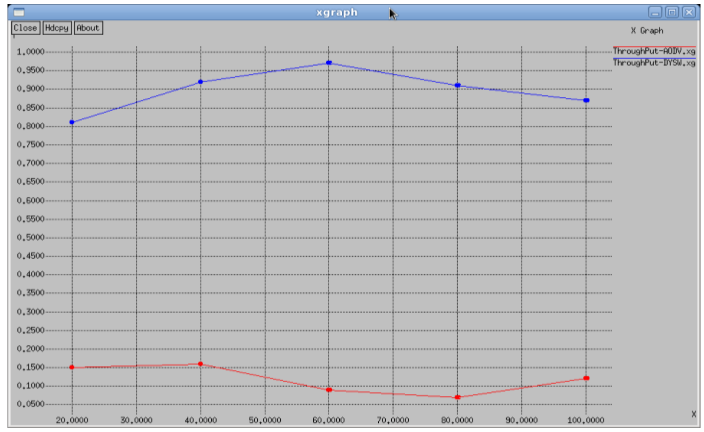

Fig. 2. Throughput vs Nodes

TABLE III
PACKET-LOSS IN SELF-ESTABLISHED SENSOR

No of Nodes	AODV	DYSW
20	**0.9345**	**0.9471**
40	**0.9491**	**0.9841**
60	**0.9541**	**0.9769**
80	**0.9612**	**0.9783**
100	**0.9651**	**0.9679**

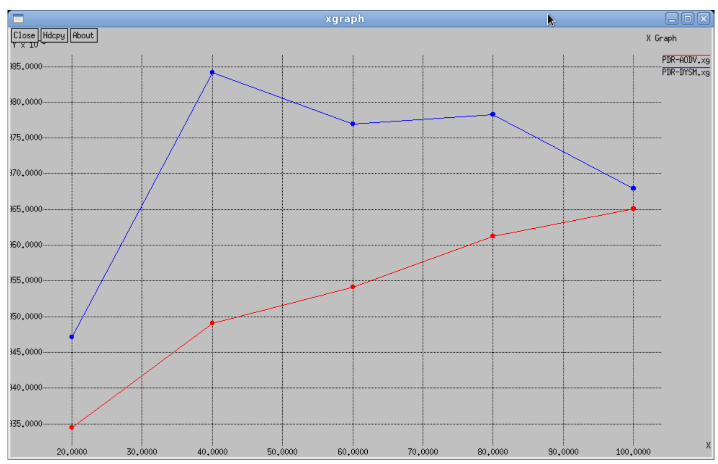

Fig. 3. Packet loss ratio

3.4 Packet Delivery Ratio

The packet delivery ratio is important in order to determine the performance of the network. The data delivery as packets is calculated from two estimations. One for calculating the packet delivery ratio can be calculated as follows:

PDR=packet received /packet transmitted

[3]Second, the packet error rate is the ratio of the number of incorrectly received packets to the number of packets transmitted. Each packet is checked for correct if at least one of its bits is also

incorrect when received. Hence, the rate of packet errors depends on the size of the packet and the probability that each bit is received incorrectly. In this paper, signal to noise (SNR) based technique is used for estimating packet error rates on a link between any two nodes. SNR is simply a measure of the received signal strength in relation to noise, given by the following expression.

$$SNR = PR_x/(I_{inter} + I_{extra} + I_{nx}) * PG \quad (3)$$

Where I_{inter} and I_{ex} are intra cell and extra cell interference respectively, and where is the spreading bandwidth and is the bit rate. P_{Rx} is Packet Received and PG is power gain. From a received packet, the estimated SNR provides a basis for calculating bit error rates (BER) for the packet as in [10].

BER is the ratio of the number of bits which are received incorrectly to the total number of bits transmitted over some time interval. The ratio between AODV and Dynamic Switching is Specified in table-5.BER therefore provides estimates for bit error probability along a link in a wireless channel.

TABLE IIV
PACKET DELIVERY RATIO IN DYNAMIC NETWORK

No of Nodes	AODV	DYSW
20	0.0758	0.0458
40	0.0842	0.0542
60	0.0882	0.0532
80	0.0872	0.0572
100	0.0911	0.0611

The packet delivery ratio for the dynamic switching sensor is similar to the AODV Routing. When the delay for switching is appropriate, then the delivery ratio will be increased is shown in Fig-5.

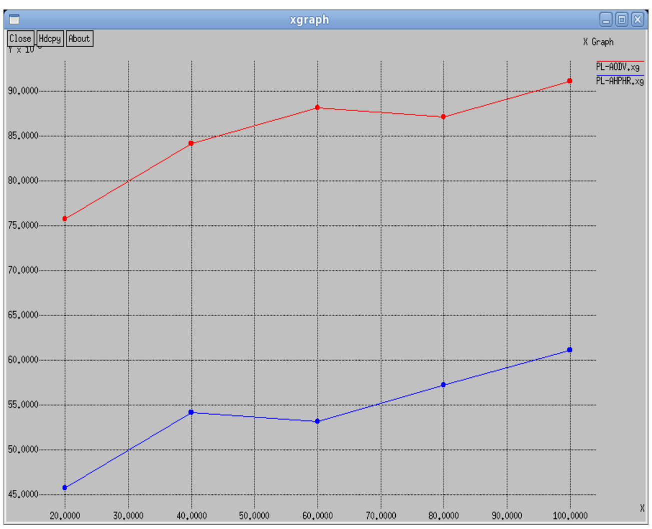

Fig. 4. Packet Delivery Ratio

4 CONCLUSION

The dynamic sensor network is the emerging trends in today's sensor networking and the adaptability of the sensors to any type of environmental condition is needed to be fulfilled. The adapted sensor should perform an optimistic behavior and have an equivalent resource similar to the normal sensor as deployed, such adaptation can be made better by providing a dynamic switching between the actual sensor and the background sensor under real-time constraints to reduce the failure rate. There is a decrease in the switch of 2.5% than other existing method.

Further, this work is carried on for mobility of the sensor and can switch to any background sensor in the deployed environment.

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