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Applications of Wireless Sensor Network By Avoiding Congestion

S.Surekha, C.Rajendra

***Abstract:** Wireless Sensor Networks (WSNs) have emerged as an important new area in wireless technology. In many real-life environment applications of WSN's, data is generated continuously and it should reach the sink node without delay and loss. Congestion is the one of the main problem in Wireless sensor networks. Congestion detection and Avoidance in WSN's is a critical issue, it will not only affect transmission reliability, but also causes transmission delay and will waste valuable energy resources. The data flowing through the WSN have great impact on the link load. The way of handling the data against the congestion is tough task. Queue occupancy is an accurate indicator of congestion. In this paper we propose the scheme that detects efficiently congestion by using queue occupancy parameter of a node. If queue length of any node has reached maximum threshold level then data should not be transmitted through that node for certain time period to avoid congestion. It overcomes the congestion by selecting alternative neighboring node which does not cause congestion and transmit the data reliably and fastly to the destination (sink node) without delay and loss.*

***Keywords**:- Wireless network, Sensor, Congestion detection, Congestion avoidance, Low level, High level, Congestion notification (CN) bit, Alternative node selection and Queue occupancy.*

I INTRODUCTION

Wireless sensor networks that are capable of providing bounded delay guarantees on packet delivery are referred to as real-time wireless sensor networks. A vast majority of Wireless sensor network applications are real-time. Consider a wireless sensor network whose nodes report to a base-station whenever the presence or movement of humans, animals, vehicles or some other kind of object is detected. In the case of moving object, it is also desired to monitor the movement of the object. Upon receiving the data from network, the base station takes some actions. The actions may be to turn on a camera, alert guards or something else pre-specified. If the base-station gets detection messages after the object has moved out of the area where the reports originated, the camera won't be able to take the picture of the monitored object. In the case of intrusion, failing of timely tracking will let the intruder escape. Bounded latency guarantee of end-to-end packet delivery is necessary. Low power consumption and low message overhead should be achieved. The network should give guarantee to meet specified throughput and delay requirements.

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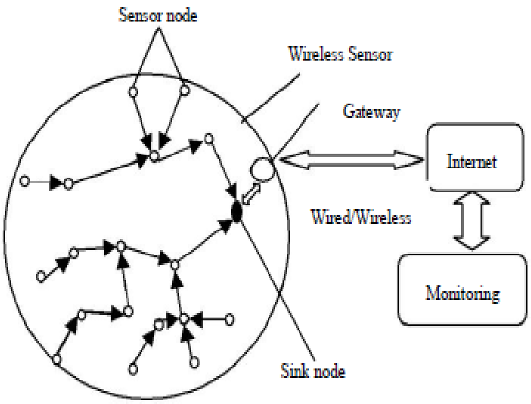


Fig. 1: Typical wireless sensor network

II LITERATURE SURVEY:

WSN applications can be categorized as event-driven or periodic data generation. For event driven data generation scenarios, the bit rate is variable. Event driven data is generated when particular event is happen. In that case large amount of data flows from sensors to sink. Depending on the application data rate formats and size of packets are different. The node must handle this traffic and control congestion in the network [1]. Congestion in a wireless sensor network (WSN) can lead to buffer overflow, wastage of resources and delay or loss of critical information from the sensor Network. The congestion may occur if the data transmission rate of previous node is high than the data processing rate of this node [2].Congestion causes many problems when sensors receives more packets than that its buffer space, the excess packets has to be dropped energy consumed by sensor nodes on the packet is wasted. And if further packet has traveled, the more waste is, which in turn diminish the network throughput and reliable data transmissions. Congestion control studies how to recover from congestion. Congestion avoidance studies how to prevent congestion from happening for this we have to monitor the parameters which can helps us to avoid congestion in WSN.

In a WSN, the data traffic load is not evenly distributed over the nodes. For example, the sensors which are one hop away from the sink relay the entire network's data traffic. This imbalanced data traffic load distribution can degrade the network's lifetime and functionality.

Then by adjusting the reporting rate of the node to the sink, we can somewhat reduce the non linearity in the traffic load. If reporting rate is very low, then it is assume that there may be chances of the congestion. ESRT [3] will give the reliability along with the congestion control with the use of the reporting rate. In CODA [4], they present a detailed study on congestion avoidance in sensor networks. The basic idea is that as soon as congestion occurs, the source (or an intermediate nodes) sending rates must be reduced to quickly release the congestion. In the simple case, as soon as a node detects congestion, it broadcasts a backpressure message upstream. An upstream node that receives the backpressure can decide to drop packets, preventing its queue from building up and thus controlling congestion. If multiple sources are sending packets to a sink, CODA also provides a method of asserting congestion control over these multiple sources by requiring constant feedback (ACKs) from the sinks. If a source does not receive the ACKs at predefined times, it will start throttling the sending rates.

In WSNs, communication is believed to dominate the energy consumption. Energy expenditure is less for sensing and computation. The energy cost of transmitting 1 Kb a distance of 100 meters is approximately the same as that for the execution of 3 million instructions by using a general-purpose processor. Thus, minimizing the energy consumption due to communication is the key for the relief of the energy constraint in WSNs. Currently, the knowledge about the communication in WSNs is still partial and vague, especially for traffic characteristics and communication patterns. Obviously, the knowledge about the traffic characteristics and communication patterns can aid in the understanding of the energy consumption and its distribution in WSNs [6].

By having early detection of the buffer, we can initiate the process of the feedback to control the congestion. This scheme is better as compare to the waiting for congestion to happen and then to take corrective action. The modified EDCAM (Early Detection Congestion Avoidance Mechanism) Algorithm will be still better as we have included the priority bit along with the congestion notification bit. This will aid the conveyance of the choke packet to reach up to the neighboring nodes. But here the drawback is when feedback is send to previous node to control bit rate in order to avoid congestion. Due to the reduction in data rate, the data will be transmitted with some delay. But in event driven data generation scenarios the data should reach the sink node without delay. Because in the event driven data generation scenarios the particular action should be taken within the specified time after an event has occurred. It should be carried out based on the data received by received by the sink node. But in the above paper, due to the decrease in bit rate the data will be transmitted with delay[5] .

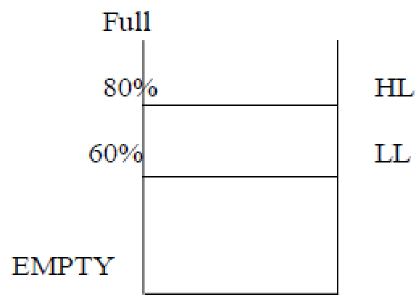
III PROPOSED SYSTEM

In most of the congestion detection mechanism the buffer occupancy is best suited as reliable method. This method gives the faster detection and feedback action taken place at right time.

We propose a technique, which will gives us the intimation of the congestion earlier than normal and avoid it by routing the data through alternative neighboring node which may not cause congestion.

Consider the buffer as 100% queue size. We define two threshold levels .One is low level(LL) and High level(HL).We consider the HL is at 80% of the buffer is full and LL is at 60% of full buffer size. For simplicity of the calculation, we consider the HL is at 80% of the full buffer size and LL is at 60% of full buffer size.

The algorithm as follows



Algorithm: Congestion algorithm with priority bit(P)

1. Watch buffer occupancy consistently.
2. If due to the incoming flow of the packets, buffer is filled. Say Lr is the current buffer occupancy.
3. If Lr >= HL, Set CN bit high and set priority bit (P) high.
4. Send this choke packet to previous node along with P and α.
5. Previous node should send the further packets using another neighboring node which does not cause congestion i.e., Lr<=LL
6. When Lr <=LL, Reset CN bit low and set priority bit (P) low.

Accurate and efficient congestion detection plays an important role in congestion control of sensor networks.

If due to incoming packets rate the buffer is filled to the level called by Lr (Current buffer occupancy). We check whether the Lr value is greater than HL (Lr ≥ HL) i.e. High Level then we set the congestion Notification (CN) bit high. And then we send this choked packet notification to the previous node to alter packet routing further through another neighboring node, (as the Lr is exceeding the HL) by the amount "α". Where the "α"ges is the status of the buffer, $0 < \alpha < 1$ that is degree of congestion.

When Lr is less than (Lr ≤ LL) i.e. Low Level then the buffer occupancy is lowered and we can reset the congestion Notification (CN) bit Low. Indicating that the buffer is not exceeding the threshold value defined and the flow rate of packet can be increased and further packets can be transmitted through this node. So the previous node may increase the flow rate by α and transmit data reliability without delay.

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The number of packet drops will be reduced and at the same time the data is transmitted to the sink node without delay and action will takes place within the specified time.

IV RESULTS

Simulations were done in NS2. Fig.2 shows the load versus the packet delivery ratio.

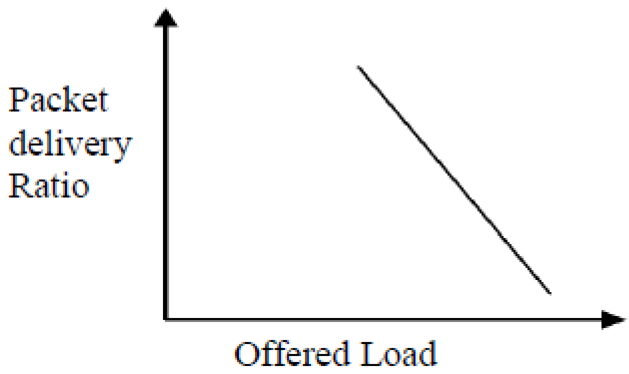

Figure2. Offered Load vs Packet delivery ratio

Graph of packet delivery ratio (number of packets received/Total number of packets sent) to offered load (packets per secon

Packet delivery ratio is defined by the ratio of Number of packets received by particular node to the Total number of packets sent by the previous nodes.

$$Packet\ delivery\ ratio = \frac{Number\ of\ packets\ received}{Total\ number\ of\ packets\ sent}$$

Offered load can be defined by the Total number of packets processed per second. The graph of packet delivery ratio to offered load signifies that, initially when number of packets processed by node is less then probability to receive the packet successfully is sufficient enough to flatten the curved graph. Afterwards when offered load increases Drop packet probability will increase and finally Packet delivery ratio decreases. After simulating actually, we will get the exact behavior of the curve whether it will drop linearly or exponentially.

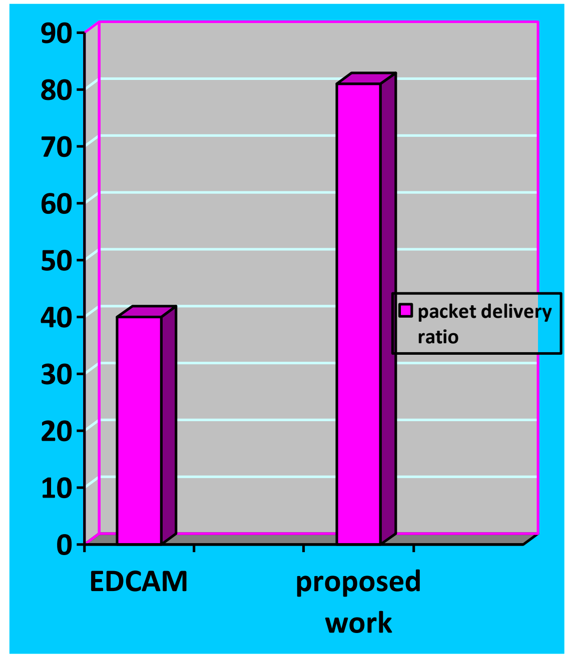

FIG:3 Packet delivery ratio of EDCAM Vs Proposed work

V CONCLUSION

By having early detection of the buffer, we can initiate the process of the feedback to control the congestion. This scheme is better as compare to the waiting for congestion to happen and then to take corrective action. The number of packet drops will be reduced and at the same time the data is transmitted to the sink node without delay and action will takes place within the specified time. After simulating the algorithm, we are going to compare the expected results to the simulated results. We compared packets delay in EDCAM technique with the technique specified in this paper.

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