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Packet Scheduling in Wireless Sensor Networks using Dynamic method

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Abstract: Real time packets should be transmitted immediately as many as possible. But the packets which transmitted from nodes which is far away from the base station should not delay. so in dynamic packet scheduling the real time and nonreal time packets are treated separately. Three priority queues are used, in which highest priority used for real time packets second priority for remote nonreal time packets and last one for local nonreal time packets. This reduces the end to end delay and average waiting time.

Keywords: Wireless sensor nodes, priority queue, delay.

I. INTRODUCTION

A network of a large number of self-organizing nodes distributed in some region is called WSN or wireless sensor network. WSN is a rapidly developing area with a wide range of potential applications like environmental monitoring, medical systems, battle fields, biometrics, industrial control, smart spaces etc. Each node in a WSN is equipped with one or more sensors, a processor, some memory and low-power radio. They are small in size, light weight and low cost. The sensors sense the surroundings and send the information to the base station (or sink) either directly or through intermediate nodes. The end user can get the information from the base station. A Dynamic Multilevel Packet (DMP) scheduling scheme brings in dynamism by virtually organizing sensor nodes into hierarchical structure based on distance to base station. This scheme maintains separate queues for real-time data, non-real-time remote data and non-real-time local data.

II. RELATED WORKS

Priority and fairness are the main limitations of existing scheduling algorithms. In pre-emptive priority scheduling the continuous arrival of real time data places the other type of data and the data packets from lower level nodes to starvation which restricts the fairness. The real time emergency data have to suffer long waiting time in non-preemptive scheduling because of other tasks execution. In this type of scheduling there is no preference to the priority of the data packets which is not suitable for large scale sensor network dynamic applications and in multilevel queue scheduling and the nodes at the lowest levels have a single ready queue consisting of both real time data and the data that is not real time , but they should be processed (executed) depending on their priorities ,if it is not the case, the real time data packets which are emergency experience long routing algorithm exist in three types flat routing ,hierarchical routing and location based routing protocols.

RAP [2] is a real time scheduling in large scale sensor networks. It proposes new packet scheduling policy called velocity monotonic scheduling. Rap significally reduce the end to end deadline missratio. Static velocity monotonic (SVM) and dynamic velocity monotonic (DVM) achieved lower miss ratio than the protocols using FCFS. But it only concentrates on real time packets so non realtime should wait for a long time.

ETRI [3] is a dynamic packet scheduling for wireless sensor network. It provides different versions to reduce energy consumption, improve information quality and performance of sensor network. This use two tier buffer model and ETRI scheduling algorithms. Each time only one version can be used. So it need more space time. Packetized dynamic batch co-scheduling algorithm [14] is developed to schedule incoming packets among multiple processors. It achieve load balancing in the presence of variable length packets, also ensures the minimal out of order departure of scheduled packets.

PSA [4] is an algorithm that schedule packets in the network layer and application layer in order to reduce network congestion in the data link layer. it reduce the packet collision and increase the throughput. The packet scheduling algorithm is to schedule packet in network layer and higher to reduce packet congestion in MAC layer and to reduce the packet collision and end-to-end delay; better packet delivery ratio is a byproduct. A greedy technique is used in this algorithm that is simple and easily implemented in a sensor node. The PSA limitation is that the average delay is more than other algorithms.

Real Time Scheduling (RTS) [4] algorithm deals with all the contributing components of the end-to-end travelling delay of data packets in sensor network to achieve better power management and stable routes when case of failure occurs. RTS delays packets at intermediate hops for a duration that is a function of their deadline. To avoid hot spotting, network allows delaying packet while maintaining deadline-faithfulness.

III. DYNAMIC PACKET SCHEDULING

Scheduling data packets among several queues of a sensor node is presented in this method. Data packets that are sensed at a node are scheduled among a number of levels

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in the ready queue. Then, a number of data packets in each level of the ready queue are scheduled. For instance, it demonstrates that the data packet, Data 1 is scheduled to be placed in the first level, Queue1. Then, Data 1 and Data 3 of Queue1 are scheduled to be transmitted based of different criteria. The general working principle of the proposed DMP scheduling scheme is illustrated in Figure 3. The proposed scheduling scheme assumes that nodes are virtually organized following a hierarchical structure. Nodes that are at the same hop distance from the base station (BS) are considered to be located at the same level. Data packets of nodes at different levels are processed using the Time Division Multiplexing Access (TDMA) scheme. For instance, nodes that are located at the lowest level and the second lowest level can be allocated timeslots 1 and 2, respectively. We consider three-level of queues, that is, the maximum number of levels in the ready queue of a node is three: priority 1(pr1), priority 2 (pr 2), and priority 3 (pr 3) queues. Real-time data packets go to pr 1 , the highest priority queue, and are processed using FCFS. Non-real-time data packets that arrive from sensor nodes at lower levels go to pr 2 , the second highest priority queue. Finally, non-real time data packets that are sensed at a local node go to pr 3 , the lowest priority queue. The possible reasons for choosing maximum three queues are to process (i) real-time pr 1 tasks with the highest priority to achieve the overall goal of WSNs, (ii) non real-time pr 2 tasks to achieve the minimum average task waiting time and also to balance the end-to-end delay by giving higher priority to remote data packets, (iii) non-real-time pr 3 tasks with lower priority to achieve fairness by preempting pr 2 tasks if pr 3 tasks wait a number of consecutive timeslots.

A. TDMA Scheme

Task or packet scheduling at each nodal level is performed using a TDMA scheme with variable length timeslots. Data are transmitted from the lowest level nodes to BS through the nodes of intermediate levels. Thus, nodes at the intermediate and upper levels have more tasks and processing requirements compared to lower-level nodes. Considering this observation, the length of timeslots at the upper-level nodes is set to a higher value compared with the timeslot length of lower-level nodes. On the other hand, real-time and time- critical emergency applications should stop intermediate nodes from aggregating data since they should be delivered to end users with a minimum possible delay. Hence, for real-time data, the duration of timeslots at different levels is almost equal and short.

B. Levels

In a particular zone several levels are available indicating certain number of nodes. Nodes which are at the same hop distance from the base station are said to be located at the same level. Nodes which are placed at the lowest as well as highest level will be allocated with separate time slots.

C. Priority

To achieve the overall goal of WSNs real time packets is being regarded as vital elements and given first priority. Based on the remotely sensed data and local data, non real time data packets are assigned. By assigning priority to the packets, real time data packets transmission delay is minimized to appreciable level. To avoid starvation of non real time packets from local nodes, packets from remote nodes can be preempted for a certain period which leads to the assurance for fairness.

D. Queue

Each node has a ready queue in which different types of tasks are placed. Scheduling among various tasks takes place with the assistance of schedulers. number of queues in a particular node will be relying on the level of the node in the network. It can be understood that nodes that are available in lowest level will not receive packets from remote location and hence does not need more number of queues. Mostly, multi-level queue can able to avoid delay since it has several working phases like aligning the tasks among different queues and scheduling.

IV. PERFORMANCE ANALYSIS

The simulation model is implemented using the python programming language. it is used to fcfs, and multilevel queue scheduling schemes. The comparison is made in terms of average packet waiting time, and end-to-end data transmission delay.

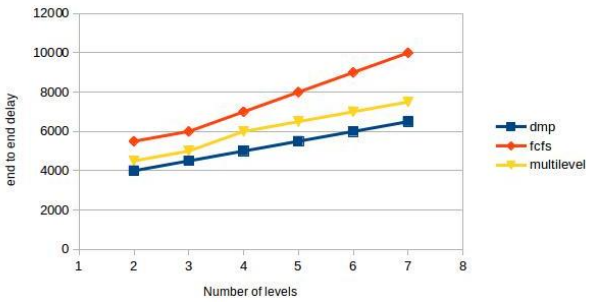

Fig. 2. This shows a figure consisting of different types of lines. This shows waiting time verses number of levels.

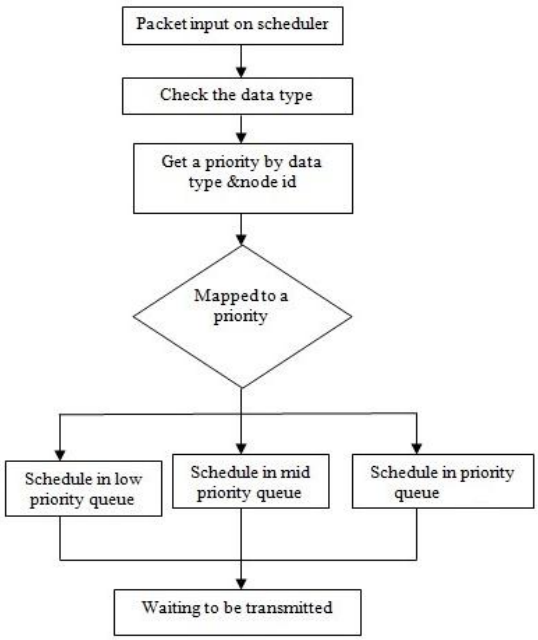

Fig. 1 flowchart of dynamic packet scheduling

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V. CONCLUSION

Wireless Sensor Networks is increasingly used for real time applications and it is an important area in networking research. This stress techniques to send the sensed data to base station as soon as possible. Scheduling is used for processing the data packets in a wireless sensor network according to their importance and urgency. Diverse packet scheduling techniques for wireless sensor networks were discussed. Active packet scheduling algorithms are static and does not provide fair least amount of delay dynamic packet scheduling algorithm provide a mechanism which provide minimum end to end delay but it does not check the time limit of packets.

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