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An Energy Efficient Multilevel Priority Packet scheduling scheme for WSN

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Abstract-Wireless sensor network(WSN) consist of compact distributed self-organizing wireless nodes with small amount of CPU memory, low processing power and low battery capacity. The wireless nodes generates different types of data packets such as real time and non-real time data packets because it sense environmental situations.
WSN uses most existing packets scheduling system i.e. First come first serve(FCFS).In FCFS concept the data packets which enter the node first will leave the node first. In this process there might be starvation of real time data packets because data packets are processed according to the time but they are not processed according to priority.
Scheduling different type of package in WSN is highly important since it ensure deliver of different type of packets based on their priority and fairness with minimum latency.

Keywords-*FIFO,Wireless Sensor Network,data waiting time, real-time, non-real-time, packet scheduling.*

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I. INTRODUCTION

Wireless sensor networks (WSN) consist of more than hundreds of small spatially distributed autonomous devices using sensors called sensor nodes to monitor the physical and environmental situations such as sound vibration, temperature, pressure, motion and intensity of light[1]. WSN has gained a great value and importance due to flexibility, cheaper implementation cost, mobility etc. The sensor networks are expected to play increasingly important role in future especially in monitoring and military applications on large scales and it consists of small and inexpensive sensor nodes that have limited memory, limited computing power, and that operate using batteries[2].

Scheduling of different packets at the sensor nodes is very important as ensures the delivery of the data packet on the priority basis. The sensed data may be real time or non-real time. Highest priority should be given to real time data sense by the node compare to non-real time data packet. Sometime the nodes may be put to sleep mode, when there is no data packet available and as soon as the data packet arrives at the node is putted into wake mode. This reduce the sensor node energy consumption[3].

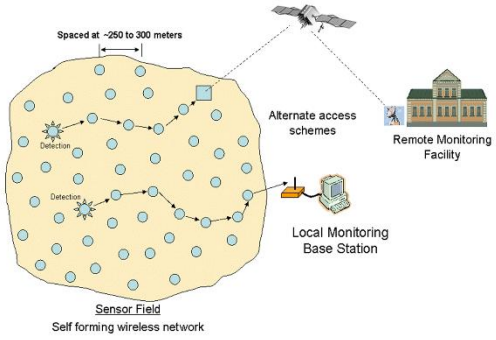

Fig.1: Diagram of energy efficientmultilevel priority packet scheduling scheme for WSN

Sensor nodes are smart, small in size light weight that monitor physical and environmental situations. The data sensed at the wireless sensor nodes is to be sent to a base station nodes via LAN connection that connects all the nodes of WSN that uses very less bandwidth base station collect the data from various nodes using single hope transmission and sometimes multi hope transmission.

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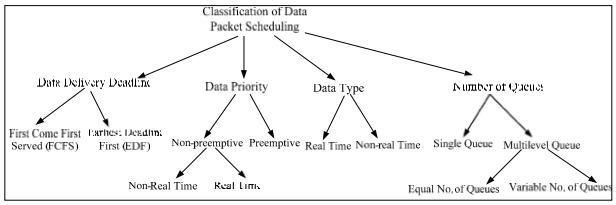

Fig. 2. Classification of packet scheduling schemes**.**

We discuss several existing WSN packet or task scheduling algorithms. Section III presents general assump- tions and terminologies. Section IV introduce the working principle and pseudo-code of the proposed DMP packet scheduling-scheme.SectionVprovidesaperformanceanalysis of the pro-posed DMP packet-scheduling algorithm for differ- ent types of traffic in terms of average task waiting time and end-to-end data transmission linger. Section VI evaluates the performance of the DMP packet scheduling scheme through pretenses and compares it against that of the existing FCFS and Multilevel Queue Scheduler algorithms [27]. Finally, Section VII con-cludes the paper defining some future research directions [5].

The packet scheduling scheme for WSN, in which overcome all drawback occurred in existing scheduling algorithm. The DMP packet scheduling scheme for WSN, in which sensor nodes are virtually organized hierarchical structure. In DMP packet scheduling scheme for WSN, where each node main-tains three level into its queue for three different types of data packets. This is because we classify data packets as (1) real time (highest or priority1), (2) non real time remote packets i.e., packet that arrive from the sensors nodes at lower level (priority 2), and (3) non real time local packet(lowest priority 3). Non-real time data packets are classified based on the loca-tion on sensor nodes to balance to end-to-end delay of data packets that are generated at different locations. Non-real time data traffic with the same priority are processed using the shortest job first (SJF) scheduler scheme since it is very effi-cient in turns of average task waiting time[4].

II. RELATED WORK

In this section, we define the following terminologies and fac-tors that are used in packet scheduling scheme.

Earliest Deadline First (EDF)[4]:-Whenever a number of data packets are available at the node and each packet has a dead-line within which it should be sent to base station. The data packet which has the earliest deadline is sent first. Data that have travelled the longest distance from the source node to base station and have the shortest deadline, are given highest priority. If the deadline of a particular data packet expires, the most suitable data packets are send at an intermediate node.

A. First Come First Serve (FCFS)[4]:-

The first come, first served scheduling system is the simplest scheduling system in which packets are processed as they come. It is the method that was used to support real-time communication. In this scheduling system it might be possible that the data packet that should reach base station as early as possible take time. Therefore to avoid time consumption the data packets are prioritized. Packet Type Packet scheduling schemes can be classified based on the types of data packets, which are as follows.

B. Real-time data packets[4]: -

Packets at sensor nodes should be scheduled based on their types and priorities. Real-time data packets are considered as the highest priority packets among all data packets that are present at the node. Hence, they are processed with the highest priority and delivered to the base station with a minimum possible end-to-end delay.

C. Non-real-time data packets[4]:-

Non-real time data packets have lower priority than real-time data packets. They are hence delivered to BS either using first come first serve or shortest job first basis when no real-time packet exist sensor node.

D. Multi-Queue Scheduler :-

E. M. Lee et al. suggested a method in to reduce the amount of exceeded deadline packet by changing delivery order among packets in the ready stream of intermediate nodes and thus reduce the packet miss ratio. They proposed a Multi-Level-Queue scheduler scheme which use different number of queue according to location of node in the network. They con-sider two methods to change the packet delivery order in in-termediate nodes: (1)SP(Simple Priority), and (2) Multi-FIFO-Queue In the first method, when a node inserts a packet to the queue, the node finds the packet's location in a ready queue according to priority. This method forms a basic solution but suffers the problem of starvation. It can be solved by checking deadline and sorting packets according to remaining time to deadline. But, this greatly increases computation. In the second method, Multi-FIFO-Queue each sensor junction consists of two or three queue according to location of node in network. Each queue has different priority such as low, high or mid. When a node gets a packet, the priority of the packet is decided by the node according to hopNetworkcount data field of packet. As leaf nodes have only its own data to send, they have only a single queue [5].

III. PRELIMINARIES

In This section, we define some of the Terminologies and ge-nera assumptions which areused in designing the Dynamic Multilevel priority (DMP) Packet Scheduling Scheme[4].

A. Assumptions

- We make some of the following assumptions to de-sign and implement DMP packet Scheduling Scheme.

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- Only real time data packets and non-real time data packets are present in the data traffic medium for e.g. non-real –time data sensed by temperature data and real-time data body sensors.
- Both types of data packets are of same size i.e. real-time and non-real –time.
- In the network all sensors node are time synchronized.
- For real- time data there is no data aggregation is performed at intermediate nodes.
- Depending upon the Number of hop counts nodes are considered located at different levels.
- By Using TDMA scheme timeslots are located to nodes.
- Each sensor nodes have ready queue which is divided into three individual queues only (For real –time data pr1, For non-real-time data pr2 and non-real-time local data pr3.
- The length is variable for data queues in sensor nodes. For instant pr1 length is smaller than pr2 and pr3 queues are same[5].

B. Terminologies

In this section, we described the following factors and terminologies which are important in designing the DMP packet Scheduling scheme[5].

C. Routing protocol

Routing protocol in which network is a virtually arrange into a hierarchical structure, considering base station act as the root node, and the sensor nodes that are adjacent to the base station are deem to be at level and nodes in zone with hop distance of 1 from base node are refer to be at level1 and so on, and nodes which are situated at the boundry are called as leaf nodes. To avoid complete depletion of Energy of a sensors node, a Zone-based Routing protocol is used[4].

D. TDMA scheme

Packet or Task Scheduling at every nodal level is done using a Time Division Multiple Access(TDMA) scheme. Every level in the Routing protocol is distributed with a time slot. There is a variation of time slots. In the design of DMP scheduling variable time slots are used because nodes at lower levels have more number of packets as compared to the nodes which are far from the base station. Considering the Observation, the length of time slots at upper-level nodes is set to a higher value[5].

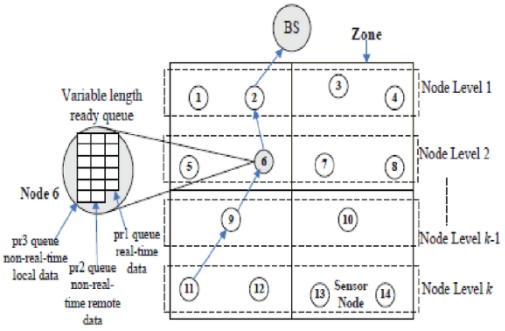

Fig.3: Proposed dynamic multilevel priority (DMP) packet scheduling scheme

Round-robin scheduling within the Queue-Depending on the scheduling the DMP packet scheduling, Data packets i.e. real-time and non-real time data packets are scheduled among the multiple queues. Existing scheduling technique are SJF and FCFS scheduling within in queue of these scheduling techniques of starvation free, so we propose a round robin scheduling neither round robin approach. In this approach the ready queue is performed as circular queue.

Following are some observations of Round robin:

By default it is preemptive algorithm rather than non-preemptive.

For processing at least once it allocates CPU to a packets in a row[5].

E. Priority

As we discussed before, there are two types of data packets, in which real-time data packets and emergency data should have highest priority and non-real-time data packets is transfer the priority depending on the sensed location and size of data. The data packets that are received by node n from the lower level are given highest priority. however, If it is noted that the lower priority non-real timer local data cannot be transmitted due to continuous coming up of higher priority and non-real-time remote data, they are preempted to allow low-priority data packets to be preserve after a inescapable waiting period[5].

F. Fairness

This metric convince hat packets of extraneous priorities find out with a minimum waiting time at the ready queue based on the priority of tasks or packets. For instance, if any lower-priority packets waits for a long period of time for the continuous reach of greater-priority packets, fairness defines a constraint that permit the lower-priority packets to attain processed after a secure waiting time.Location on sensor nodes to balance to end-to-end delay of data packets that are generated at different locations. Non-real time data traffic with the same priority are processed using the shortest job first (SJF) scheduler scheme since it is very efficient in turns of average task waiingtime.Module 1-Most existing wireless sensor network operating system use first come first serve scheduling

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system. In this scheduling system priority of data packets will not be taken into account.Data packets will be transmitted as they arrives to the node.

IV. WORKING PRINCIPLE

The proposed a threshold based technique in which the system reserves a pool of threshold number of resources to ensure that at least one process will always complete and replace all the resources it is holding. The proposed technique only considers the requesting process detail along with the system data structure to take the decision of granting or not granting of the resources incurring an overhead of waiting time. Figure 3.1 the proposed Threshold based Resource Allocation (TRA) technique architecture can be illustrate as follows: The proposed method deals with resources allocation technique that allocates the resources to the requesting processes. The system is assumed to have m resource types, i.e.,R1,R2,R3…Rm, with α1,α2,α3…αm absolve from of each type. Further, it consists of n independent

processes P1,P2,P3…Pn where, each process Pi has the attributes(▪ ▪ , ▪ ▪) that is the arrival and worst-case execution time respectively. The processes are assigned priority based on smallest execution time (Shortest job first, SJF). Several data structures are needed for maintaining the state of the resource allocation in the system [2].

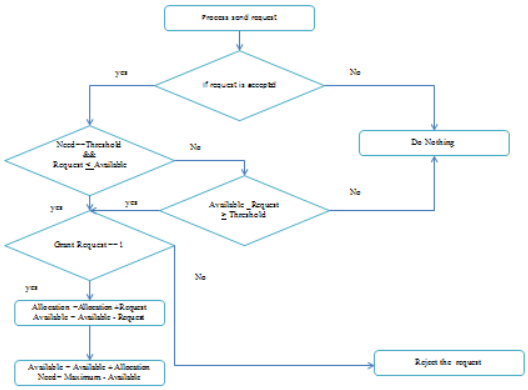

Figure 4 Working principle of TRA

V. CONCLUSION

An energy efficient multilevel priority task scheduler has better than FCFS, and multilevel queue scheduler in terms of average task waiting time, both for real-time tasks, and all types of tasks. Using the concept of three level priority queues at each node, the proposed DMP task scheduling scheme allow different types of data packets to be processed base on their priorities. Dynamic Multilevel Priority (DMP) packet scheduling scheme, its prerequisites and the factors that are being considered in the algorithm. This paper deals with issues such as – how the starvation of both types of data packets is avoided, how the processing overload, average end-to-end delay is reduced for the delivery of both real-time and non-real-time data packets. We studied the DMP packets scheduling scheme that improves the overall performance of scheduling in a WSN[4].

VI. REFERENCES

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