An Optimal Scheduling Scheme for Wireless Sensor Network

A.Vanajalakshmi[1] Dr.P.Murugeshwari[2]
[1]PG Scholar [2]Professor
[1,2]Department of Computer Science & Engineering
[1,2]Sri Vidya College of Engineering and Technology

Abstract— In Wireless Sensor Network (WSN) is an emerging technology for data transfer through a number of sensor nodes. The main cause of wasted energy consumption is packet collision. The sensor nodes are powered by batteries with limited energy. Packet scheduling is the process of resolving contention for shared resources in a network. Scheduling algorithms for every network need to be selected based on the type of users in the network and their QoS requirements. Due to transferring the data packet collision may occur so we are using scheduling algorithm. The project proposes Earliest Dead-line First (EDF) scheduling algorithm for scheduling the data packets in the queue for each node. The proposed scheduling algorithm is used for queue based scheduling because of which we can reduce the energy, transmission delay and packet loss. The queue is filled with earliest sending packets consist of lower size inside the queue so that the traffic can be reduced, the node energy can be maintained and delay of the packet cannot occur.

Key words: WSN, Packet Scheduling, Traffic, Packet collision, QoS, EDF

I. INTRODUCTION

Wireless sensor network (WSN)[1] is an leading technology to transfer data between the sensor nodes. In recent years wsn is an potential to our life, from environment monitoring and business asset management .Advances in wsn are micro-fabrication and integration , embedded microprocessors have transmitted on a sensor network describes conditions of physical environments-for example, temperature, humidity. Sensor network is designed to perform a set of high level information such as detection, tracking or classification. Sensor nodes can communicate with other sensor nodes in a network, which may transfer packets within the network.

During the transmission of data packets a collision may occur due to number of traffics in the network. These collisions will lead to the loss of the packet. Thus the packet scheduling is used to schedule the packet in the sensor nodes. In wsn, packet scheduling is the vast area used to send packets in different network. In sensor nodes before sending the packets which may store the data's in the queue. If suppose the queue is full then the receiving packet will loss. To overcome this problem packet scheduling is used.

The packets are considered in two ways ―real-time‖ and ―non-real-time‖. Real time packets are considered as highest priority among all the data packets in the ready queue. Hence they are processed with a minimum end-to-end delay. T he non-real time packets have lowest priority than real time tasks.

A hybrid scheduling algorithms combines Earliest Deadline First (EDF), Weighted Fair queuing (WFQ) and First in First out (FIFO) scheduling algorithms. The overall allocation of bandwidth is done in a strict priority manner i.e. all the higher priority SSs are allocated bandwidth until they do not have any packets to send.

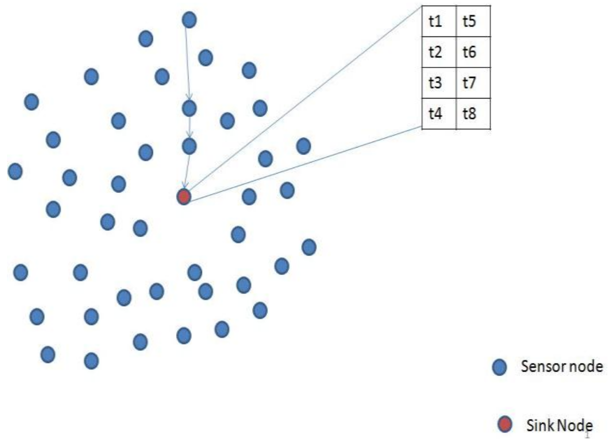

Fig. 1: Packet Scheduling in WSN

In fig 1 shows the transferring of packets within the network and scheduling the packets in the queue of the sensor nodes.

II. TRAFFIC ANALYSIS

The communication traffic [2] in WSN is very dependent on the application using in the network. The traffic affects the queue in the sensor then it makes delay and packet loss while transferring the packets. In WSN the traffic analysis are used in both wired and wireless. The data traffic in WSN is quite different WSN applications can be categorized as event-driven or periodic data generation. For periodic data generation scenarios, constant bit rate (CBR) can be used to model the data traffic arrival process when the bit rate is constant . When the bit rate is variable, a Poisson process can be used to model the data traffic arrival process as long as the data traffic is not bursty . For event-driven scenarios such as target detection and target tracking, bursty traffic can arise from any corner of the sensing area if an event is detected by the local sensors. There are two types of traffic analysis attack there are ,

(1) Rate Monitoring Attack
(2) Time Correlation attack

In a rate monitoring attack, an adversary exploits the observation that the nodes nearer a base station tend to send/forward more packets than the nodes further away from a base station, due to the tree structured nature of traditional WSNs that direct data towards the base station collection point. An adversary can monitor the packet sending rate of nodes and follow the direction and paths of increasing packet traffic towards the base station.

In a time correlation attack, an adversary is able to generate some events, e.g. abnormal temperature, sounds, or lights, and monitors where the sensor nodes forward the packet reports. Even if the adversary doesn't understand the contents of the packet, monitoring the packet sending time enables an adversary to identify and track with reasonable likelihood the same report message as it propagates through different nodes to a base station.

III. PACKET SCHEDULING

Dynamic Window Constrained Scheduling for Multimedia Applications [3] ,where it describes an algorithm, called Dynamic Window-Constrained Scheduling (DWCS), designed to meet the service constraints on packets from multiple, network-bound media streams with different performance objectives. Using only two attributes, a deadline and a loss-tolerance per packet stream, DWCS: (1) can limit the number of late packets over finite numbers of consecutive packets in loss-tolerant or delay constrained, heterogeneous traffic streams, (2) does not require a-prior knowledge of the worst-case loading from multiple streams to establish the necessary bandwidth allocations to meet per-stream delay and loss constraints, and (3) can exhibit both fairness and unfairness properties when necessary. In fact, DWCS can perform fair-bandwidth allocation, static priority (SP) and earliest-deadline first (EDF) scheduling. We show the effectiveness of DWCS using a streaming video application, running over ATM.

"Analysis of a Window-Constrained Scheduler for Real-Time and Best-Effort Packet Streams,‖ [4] which describes how Dynamic Window-Constrained Scheduling (DWCS) can guarantee real-time service to packets from multiple streams with different performance objectives. We show that: [4](1) DWCS can guarantee that no more than x packets miss their deadlines for every y consecutive packets requiring service, using DWCS, the delay of service to real-time packet streams is bounded even when the scheduler is overloaded, DWCS can ensure the delay bound of any given stream is independent of other streams, and a fast response time for best-effort packet streams, in the presence of real-time packet streams, is possible. As long as the minimum aggregate bandwidth requirement of all real-time packet streams does not exceed the available bandwidth, DWCS can guarantee that each such stream does not miss more than x deadlines for every y requests. Furthermore, if a feasible schedule exists, each stream is guaranteed a minimum fraction of available bandwidth over a finite window of time. Consequently, DWCS can provide bounded delay of service to each real-time stream in a manner which is independent of other streams, while also meeting per-stream, explicit delay and loss constraints.

"Scalable Scheduling Support for Loss and Delay Constrained Media Streams‖[6] which describes the practical issues concerned with the implementation of a scalable real time packet scheduler resident on a server, designed to meet service constraints on information transferred across a network to many clients. Specifically, we describe the implementation issues and performance achieved by Dynamic Window-Constrained Scheduling (DWCS), which is designed to meet the delay and loss constraints on packets from multiple streams with different performance objectives. In fact, DWCS is designed to limit the number of late packets over finite numbers of consecutive packets in loss-tolerant and/or delay-constrained, heterogeneous traffic streams. We show how DWCS can be efficiently implemented to provide service guarantees to hundreds of streams.

―Start-time fair queuing: A scheduling algorithm for integrated services packet switching networks,‖ Most code dissemination protocols are based on the centralized approach in which only the base station has the authority to initiate code dissemination. However, it is desirable and sometimes necessary to disseminate code images in a distributed manner which allows multiple authorized network users to simultaneously and directly update code images on different nodes without involving the base station.

IV. SYSTEM MODEL

The medium access control (MAC) layer plays a crucial role in handling the energy consumed on communication and trusts the latency in check. In this project, a real time wireless media access control (MAC) protocol based on EDF scheduling scheme is proposed. The project considers the efficient implementation of stream scheduling on high speed programmable network processors. The processors attain high processing speed by exploiting parallelism to hide memory latency. If the network processor is serving two Gigabit ports, one packet should be sent out every 500 – 600 micro engine cycles, while each memory access takes about 20 cycles to complete. Although the latency can be somewhat hidden by context switching, memory intensive data structures like heaps or linked lists make it difficult to meet these requirements. An outcome is the need for new designs that address the limitation of memory-intensive data structures.

The below steps are benefits for proposed method,

- Low traffic load (no additional delay due to congestion, interference/collision).
- Fixed packet length slot for a single packet transmission and fixed number of slots.
- Each node is assigned one of *k* slot as an active slot.
- Node can only receive the packet in its active slot.
- Node can wake up in any active slot of the neighbors to transmit the packet.

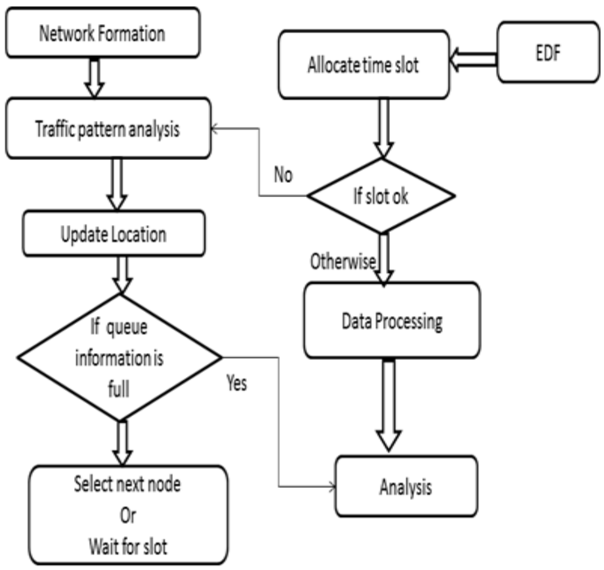

Fig. 2: System Model

V. NETWORK FORMATION

Inter organizational networks emerge as a result of the interdependencies between organizations that ensure organizations to interact with each other and lead in time to network structures. Where hierarchical arrangements can be purposely planned, networks are reactionary since they emerge out of contextual events that initiate the formation of a collaborative network. Although network emergence is well studied, the process in which networks come into being and evolve through time is not as well known. Mainly due to the difficulties in terms of data collection and analysis. This is especially the case for public sector networks since network evolution studies are predominantly focused on the private sector. It suggests that networks evolve through a cyclical approach.

VI. ROUTE DISCOVERY

Choosing route points is a crucial step of the data gathering process since it determines the efficiency of energy transferring and the latency of data gathering. A trivial scheme is to simply visit all the sensor nodes, gather data through single-hop transmission and use the Sensor to forward data back to the static sink through long range communications. However, this scheme would trigger several new problems in our data collection and wireless recharge scheme. First, using single-hop data collection can only collect data from a very small number of nodes per interval. Only the nodes reside at the anchor points are able to transmit data while data generated at other nodes is not collected. Therefore, the fairness of data collection among all the nodes is greatly undermined in single hop data collection.

VII. SIMULATION GRAPH

In the below figure, it defines the packet forwarding time from sender to receiver when compared to the existing algorithm the proposed algorithm has low forwarding time. Therefore the no.of packets received by the destination node is large even for a small simulation time.

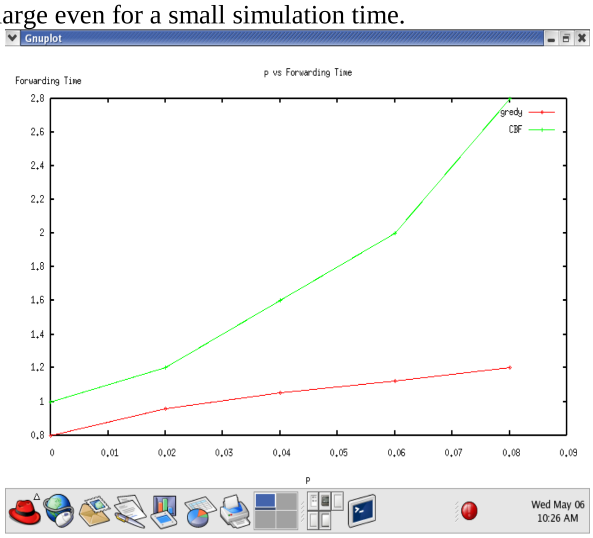

Fig. 3: Packet Sending VS Forwarding Time

In the below graph, it explains the end2end delay for each node density when compared to the existing algorithm the end2end delay is low.

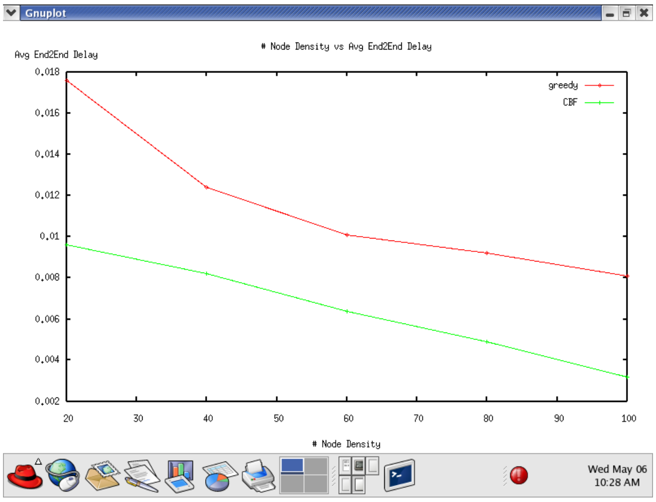

Fig. 4: Node Density VS Average End2End Delay

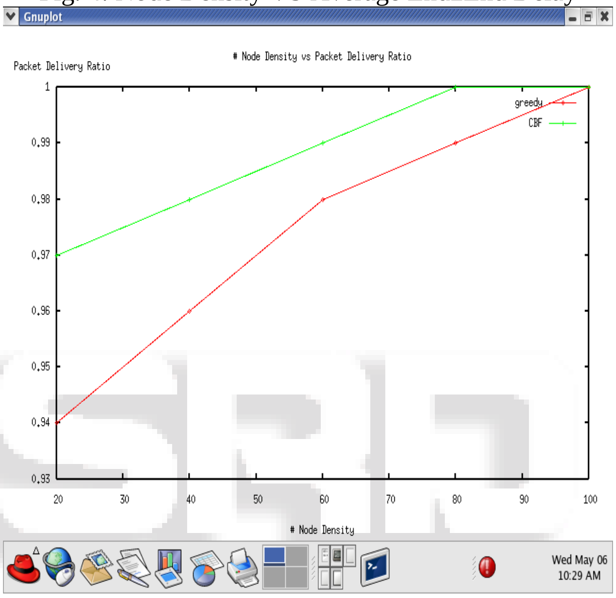

Fig. 5: Node Density VS PDR

In fig 5 it explains about the packet delivery ratio for the no.of nodes. The existing algorithm has the low no.of packet delivery ratio upto the no.of node is 60. But in a proposed algorithm the packet delivery ratio is constant over the increasing no.of nodes.

VIII. CONCLUSION:

In wireless sensor network the traffic may occur during the transmission of data packets in the sensor networks, by which the packet loss may occur. To increase the efficiency of performance the packet loss may control by scheduling the packets. The packet scheduling will increase the transmission rate and reduce the end-to-end delay.

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