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A Multilevel Priority Packet Scheduling Scheme for Wireless Sensor Network (WSN)

Achyutha Prasad N
Assistant Professor
Department of Computer Science & Engineering
Sri Siddhartha Institute of Technology, Tumkur

Dr. Siddaraju
Professor & Head
Department of Computer Science & Engineering
Dr. Ambedkar Institute of Technology, Bangalore

Abstract- **Planning distinctive sorts of parcels, for example, ongoing and non-continuous information bundles, at sensor hubs with asset imperatives in Wireless Sensor Networks (WSN) is of key significance to decrease sensors' vitality utilizations and end-to-end information transmission delays. The vast majority of the current parcel booking systems of WSN utilizes First Come First Served (FCFS), non-preemptive need and preemptive need planning calculations. These calculations acquire a high handling overhead and long end-to-end information transmission delay because of the FCFS idea, starvation of high need ongoing information parcels because of the transmission of a vast information bundles Moreover, these calculations are not element to the changing prerequisites of WSN applications since their planning arrangements are foreordained. In proposed Dynamic Multilevel Priority (DMP) bundle booking plan, where every hub, aside from those at the last level of the virtual chain of importance in the zone based topology of WSN, has three levels of need lines. Continuous parcels are put into the most noteworthy need line and can pre-empt information bundles in different lines. Non-continuous bundles are put into two different lines in view of a specific limit of their assessed preparing time.**

Keywords: WSN, FCFS, DMP, BS

1. Introduction

Among numerous system plan issues, for example, steering conventions and information accumulation, that decrease sensor vitality utilization and information transmission delay, parcel planning at sensor hubs is very vital since it guarantees conveyance of various sorts of information bundles taking into account their need and decency with a base idleness. Case in point, information detected for ongoing applications have higher need than information bundles in the request of their landing time and, in this way, require a great deal of time to be conveyed to an applicable base station (BS). In any case, to be important, detected information need to achieve the BS inside of a particular time period or before the lapse of a due date. Also, continuous crisis information ought to be conveyed to BS with the most brief conceivable end-to-end delay. Subsequently, middle of the road hubs require changing the conveyance request of information parcels in their prepared line in view of their significance (e.g., genuine or non-constant) and conveyance due date. Besides, most existing bundle planning calculations of WSN are neither element nor suitable for expansive scale applications since these schedulers are foreordained and static, and can't be changed in light of an adjustment in the application prerequisites or situations. For instance, in numerous continuous applications, a constant need scheduler is statically utilized and can't be changed amid the operation of WSN applications. In this venture proposition a Dynamic Multilevel Priority (DMP) parcel planning plan for WSNs in which sensor hubs are practically sorted out into a progressive structure. Hubs that have the same bounce separation from the BS are thought to be situated at the same various leveled level. Information bundles detected by hubs at various levels are handled utilizing a TDMA plan. Case in point, hubs that are situated at the most minimal level and one level upper to the least level can be distributed timeslots 1 and 2, separately. Every hub keeps up three levels of need lines. This is on account of we order information bundles as (i) continuous (need 1), (ii) non-ongoing remote information parcel that are gotten from lower level hubs (need 2), and (iii) non-constant nearby information parcels that are detected at the hub itself (need 3). Non-ongoing information activity with the same need are handled utilizing the most limited employment first (SJF) scheduler plan since it is extremely proficient as far as normal errand holding up time .

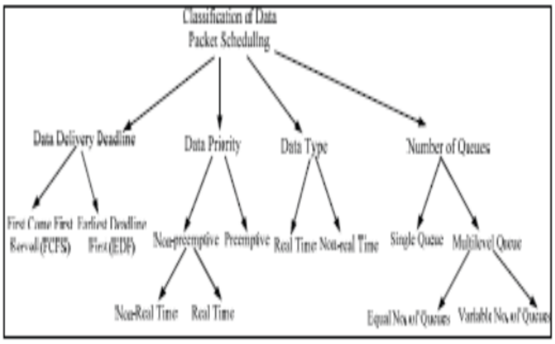

Fig1.1: Classical of Packet Scheduling Schemes

Remote sensor system (WSN) is spatially appropriated self-governing sensors to screen the natural or physical conditions, for example, power, movement rates, fire discovery and base security. Sensors are little in size with restricted handling and figuring assets, and they are reasonable contrasted with customary sensors. Every sensor hub is dependable to sense, measure, and assemble data from nature and in view of some neighborhood choice procedure, they can transmit the detected information to the client. Keen sensor hubs are low power gadgets outfitted with one or more sensors, a processor, memory, a force supply, a radio, and an actuator. Subsequent to the sensor hubs have restricted memory and are commonly conveyed in hard to-get to areas, a radio is executed for remote correspondence to exchange the information to a base station [1]. Battery is the fundamental force source in a sensor hub. Auxiliary power supply that collects power from nature, for example, sunlight based boards might be included to the hub depending the suitability of the earth where the sensor will be sent [1]. Contingent upon the application and the sort of sensors utilized, actuators might be fused in the sensors. A WSN normally has almost no base. It comprises of various sensor hubs (couple of tens to thousands) cooperating to screen a locale to get information about the earth. There are two sorts of WSNs: organized and unstructured. An unstructured WSN is one that contains a thick gathering of sensor hubs. Sensor hubs might be sent in a specially appointed way into the field. In an organized WSN, all or a percentage of the sensor hubs are sent in a pre-arranged way. The upside of an organized system is that less hubs can be conveyed with lower system upkeep and administration cost. Less hubs can be conveyed now since hubs are put at particular areas to give scope while impromptu arrangement can have revealed districts. The intricacy of remote sensor systems which by and large comprise of an information procurement system and an information dissemination system checked and controlled by an administration focus. The investigation of remote sensor systems is trying in that it requires a tremendous expansiveness of learning from a gigantic assortment of controls. [2][3]

A sensor system is a base included expansive number of sensor hubs used to screen the earth. Notwithstanding detecting it is likewise utilized as a part of control and actuation.

The fundamental segments in a sensor system:

- An get together of disseminated or restricted sensors
- A system which is inside associated
- An essential issue of data bunching
- A set of figuring assets at the essential issue.

The calculation and correspondence base connected with sensor systems is regularly particular to this environment and established in the gadget and application-based nature of the systems. Today's sensors can be portrayed as brilliant modest gadgets outfitted with various locally available detecting components; they are minimal effort low-control multifunctional hubs that are legitimately homed to a focal sink hub. The intricacy of remote sensor systems which for the most part comprise of an information obtaining system and an information circulation system checked and controlled by an administration focus [3].

2. Related Work

G. Anastasi, M. Conti, and M. Di Francesco

Several communication-theoretic-oriented approaches have been proposed to study decentralized detection . In, the authors follow a Bayesian approach for the minimization of the probability of decision error at the access point (AP). Most of the proposed approaches are based on the assumption of ideal communication links between the sensors and the AP. However, in a realistic communication scenario, these links are likely to be noisy . In the presence of noisy communication links, modeled as binary symmetric channels (BSCs), is considered and a few techniques are proposed to make the system more robust against the noise.We show the benefits, in terms of longer network lifetime, of adaptive reclustering. We also derive an analytical framework for the computation of the network lifetime and the penalty, in terms of time delay and energy consumption, brought by adaptive reclustering. On the other hand, absence of reclustering leads to a shorter network lifetime, and we show the impact of various clustering configurations under different QoS conditions.

G. Bergmann, M. Molnar, L. Gonczy

Wireless sensor networks have recently received increased attention for a broad array of applications such as surveillance, environment monitoring, medical diagnostics, and industrial control. As wireless sensor nodes usually rely on portable power sources such as batteries to provide the necessary power, their power management has become a crucial issue. It has been observed that idle energy plays an important role for saving energy in wireless sensor networks [2]. Most existing radios (i.e., CC2420) used in wireless sensor networks support different modes, like transmit/receive mode, idle mode, and sleep mode. In idle mode, the radio is not communicating but the radio circuitry is still turned on, resulting in energy consumption which is only slightly less than that in the transmitting or receiving states. In order to save idle energy, it is necessary to introduce a wakeup mechanism for sensor nodes in the presence of pending transmission.

E. Bulut and I. Korpeoglu

Wireless sensor networks consists of small and inexpensive sensor nodes that have limited memory, limited computing power, and that operate using batteries . Since most of the time the batteries of sensor nodes are unchangeable and unrechargeable, the available energy in the batteries determines the lifetime of the sensor network. Therefore the battery energy of sensor nodes has to be very carefully and cleverly utilized. Additionally, it is also very important to balance the energy consumption of the nodes so that the network stay connected and functional for a long time.DSSP (Dynamic Sleep Scheduling Protocol), a centralized scheme for extending the lifetime of densely deployed wireless sensor networks by keeping only a necessary set of sensor nodes active. We present an algorithm for finding out which nodes should be put into sleep mode, and the algorithm preserves coverage and connectivity while trying to put as much nodes as possible into sleep mode.

S. Chachra and M. Marefat

We consider setting up sleep scheduling in sensor networks. We formulate the problem as an instance of the fractional domatic partition problem and obtain a distributed approximation algorithm by applying linear programming approximation techniques. Our algorithm is an application of the Garg-K¨onemann (GK) scheme that requires solving an instance of the minimum weight dominating set (MWDS) problem as a subroutine. Our two main contributions are a distributed implementation of the GK scheme for the sleep-scheduling problem and a novel asynchronous distributed algorithm for approximating MWDS based on a primal-dual analysis of Chv´atal's set-cover algorithm.The sleep-scheduling problem can be modeled using a pairwise redundancy relationship between sensor nodes. In the resulting redundancy graph adjacent nodes represent sensors that can measure the same data.

P. Guo, T. Jiang, Q. Zhang, and K. Zhang

Wireless Sensor Networks (WSN) is a collection of spatially deployed wireless sensors by which to monitor various changes of environmental conditions (e.g. forest fire,air pollutant concentration and object moving) in a collaborative manner without relying on any underlying infrastructure support. Recently, a number of research efforts have been made to develop sensor hardware and network architecture in order to effectively deploy WSNs for a variety of applications. Many network parameters such as sensing range, transmission range and node density have to be carefully considered at the network design stage, according to specific applications. To achieve this, it is critical to capture the impacts of network parameters on network performance with respect to application specifications. Since a distributed network has multiple nodes and services many messages and each node is a shared resource, many decisions must be made. There may be multiple paths from the source to destination. Therefore, message routing is an important topic. The main performance measures affected by the routing scheme are throughput (quality of service) and average packet delay (quantity of service).To overcome this problem by using local monitoring, each node oversees part of the traffic going in and out of its neighbors to determine if the behavior is suspicious, such as, unusually long delay in forwarding a packet. Here, a protocol is used to make local monitoring parsimonious in its energy consumption and to integrate it with any extant sleep-wake protocol in the network.

3. PROPOSED SYSTEM

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 (pr2), and priority 3 (pr3) queues. Real-time data packets go to pr1, the highest priority queue, and are processed using FCFS. Non-real-time data packets that arrive from sensor nodes at lower levels go to pr2, the second highest priority queue. Finally, non-real time data packets that are sensed at a local node go to pr3, the lowest priority queue.

The conceivable explanations behind picking most extreme three lines are to process (i) continuous pr1 errands with the most astounding need to accomplish the general objective of WSNs, (ii) non constant pr2 undertakings to accomplish the base normal assignment holding up time furthermore to adjust the end-to-end delay by giving higher need to remote information parcels, (iii) non-ongoing pr3 errands with lower need to accomplish reasonableness by seizing pr2 assignments if pr3 undertakings hold up various back to back timeslots. In the proposed plan, line sizes vary in view of theapplication prerequisites. Following preemptive need booking brings about overhead because of the setting stockpiling and exchanging in asset limitation sensor arranges, the span of the prepared line for preemptive need schedulers is relied upon to be littler than that of the preemptable need schedulers. The thought behind this is the most elevated need continuous/crisis errands once in a while happen. They are in this way put in the preemptivepriority assignment line (pr1 line) and can acquire the right now running undertakings. Subsequent to these procedures are little in number, thenumber of appropriations will be a couple. Then again, nonreal-time parcels that land from the sensor hubs at lower level are put in the preemptable need line (pr2 line). The preparing of these information bundles can be seized by the most elevated need constant undertakings furthermore after a specific time period if errands at the lower need pr3 line don't get handled because of the nonstop landing of higher need information parcels. Continuous bundles are generally handled in FCFS style. Every parcel has an ID, which comprises of two sections, to be specific level ID and hub ID. At the point when two equivalent need parcels land primed and ready line in the meantime, the information bundle which is produced at the lower level will have higher need. This marvel decreases the end-to-end deferral of the lower level undertakings to achieve the BS. For two errands of the same level, the littler assignment (i.e., regarding information size) will have higher need. In addition, it is normal that when a hub x faculties and gets information from lower-level hubs, it can prepare and forward most information inside of its apportioned timeslot; consequently, the likelihood that the prepared line at a hub turns out to be full and drops bundles is low. Notwithstanding, if any information stays in the prepared line of hub x amid its dispensed timeslot, that information will be transmitted in the following assigned timeslot. Timeslots at every level are not altered. They are fairly ascertained in view of the information detecting period, information transmission rate, and CPU speed. They are expanded as the levels progress through BS. In any case, if there is any ongoing or crisis reaction information at a specific level, the time required to transmit that information will be short and won't increment at the upper levels subsequent to there is no information accumulation. The remaining time of a timeslot of hubs at a specific level will be utilized to process information parcels at different lines. Following the likelihood of having constant crisis information is low, it is normal that this situation would not corrupt the framework execution. Rather, it might enhance the apparent Quality of Service (QoS) by conveying ongoing information quick. In addition, if any hub x at a specific level finishes its errand before the termination of its distributed timeslot, hub x goes to rest by killing its radio for the purpose of vitality effectiveness.

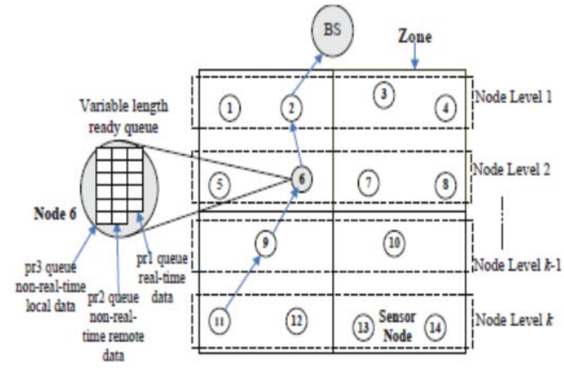

Fig 2.1: Proposed Dynamic Multi-level Priority (DMP) packet Scheduling Scheme

CONCLUSION

Dynamic Multilevel Priority (DMP) scheme uses three-level of priority queues to schedule data packets based on their types and priorities. Multilevel Queue Scheduler in terms of the average task waiting time and end to end delay. As enhancements to the proposed DMP scheme, we envision assigning task priority based on task deadline instead of the shortest task processing time. To reduce processing overhead and save bandwidth, we could also consider removing tasks with expired deadlines from the medium. Furthermore, if a real-time task holds the resources for a longer period of time, other tasks need to wait for an undefined period time, causing the occurrence of a deadlock. This deadlock situation degrades the performance of task scheduling schemes in terms of end to- end delay. Hence, we would deal with the circular wait and preemptive conditions to prevent deadlock from occurring. We would also validate the simulation result using a real test-bed.

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