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MARS: SECTORING SCHEME TO IMPROVE RELIABILITY IN WSN

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Abstract- Wireless Sensor Networks (WSN), consisting of a large number of sensor nodes connected through wireless standard has emerged as an innovative expertise that offers the unprecedented ability to monitor the physical world accurately. Because of resource-constrained nature of sensor nodes, it adds up to the problems have emerged out of which reliability is an important matter of concern. In order to improve reliability of each sensor node, the proposed MARS algorithm uniformly divides the sensing area into sectors where the sector head is most nearest node from the sink for each sector area. The Sector Head (SH) selection phase of a random sector based wireless sensor network (WSN) has been assumed as an insignificant factor in the previous research works. In this paper, reliability is observed by different parameters like packet delivery ratio, packet loss ratio, routing overhead, delay, throughput and energy consumed against packet size.

Keywords- Wireless Sensor Networks, Reliability, Sectoring, Sector head, Common node, Network Performance

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Introduction

A wireless Sensor network is apprehend as a collection of sensor nodes that are proficient of sensing physical phenomena, in the neighborhood processing the sensed data, and finally route the atypical or summative data to a remote base station. WSN is highly isolated self-organized systems. They depend on significant numbers of sprinkled low-cost minute devices featuring strong restrictions in terms of processing, memory, communications and energy capabilities. Sensor nodes congregate aptitude of consciousness over a given space, making them easy to get to external systems and networks at particular nodes designated sink nodes. WSNs are collection of communication networks consisting of different free sensors that kindly observe some material or ecological conditions, such as temperature, sound, vibration, pressure, motion or pollutants at different locations. They are used in special applications including: commercial and industrial applications, environment applications, health care applications, home automation, traffic control and monitoring, object tracking and fire detection [1]. WSN provide a cheap, fully distributed. Sensing and computing solution for environments where conventional networks are impractical [2]. This paper explores the intend assessment related to given that reliable data transport in sensor nets. The reliable data transport problem in sensor nets is all-around. Therefore, assuring reliable data delivery between sensor nodes and the sink in WSN is a tough task. A reliable protocol in wireless sensor network is a protocol that allows data transfer reliably from source to destination with reasonable packet loss [3]. Most of the presented transport protocols only provide reliable data transport or congestion control. However, there are several protocols that offer both functions of the transport protocol. To conquer these issues, the transport layer protocols that provide together consistent data release and congestion control should be taken under deliberation. Transport layer algorithm also allows maximum network existence owing to restricted in use lifetime of sensor node. Thus, to extend the lifetime of wireless sensor network, an efficient transport protocol need to bear reliable message delivery and provide congestion control in most energy efficient protocols [4].

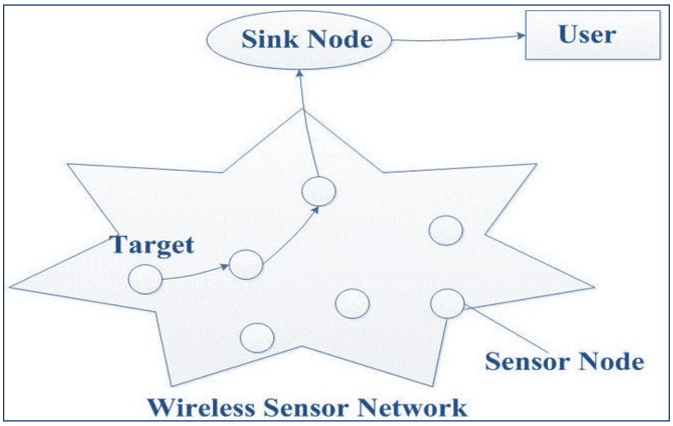

Fig. 1- Structure of WSN

[Fig-1] shows the basic scenario of wireless sensor network, with some sensor node and sink node. When event is occurs i.e. target node send their packets to sink node with some route.

Significance of Reliability

The necessitate for reliability in a sensor network is determinedly needy upon the exacting application the sensor network is used for. Consider a sensor network deployed to detect the incidence of harmful gases in an engaged building, with the sink having the ability of issuing queries indicating what specific gas the sensors should attempt to detect. Given the nature of the application, it is totally serious that a query update reaches the sensors in a reliable manner. As we complicated later, the detailed appearance of reliability might revolutionize from application to application [5]. Packet Reliability applications is loss sensitive and necessitate unbeaten transmission of all packets. Besides delivery of queries, reliability will also be required when control software is downloaded to upgrade the sensors. By using upstream and downstream message is carried out in wireless sensor network. For upstream communication, the sender is a sensor node and receiver is a sink node and in reverse order, downstream is work [10].

Related Work

Packet Delivery Ratio: It is ratio number of packets received and number of packets generated.

Routing Overhead: The overhead occurred in the handshaking for routing the data.

Delay: Delay is one more constraint where it is very significant in case of real time data transfer. In audio and video it doesn't matter much as it is soft real time. So depending upon the obligation delay parameters is analyzed.

Energy Consumptions: Energy Consumptions also a parameter to be analyzed in case of wireless sensor networks as the sensors gather information throughout the day the power saving is very important, if more number of retransmission the control utilization will be more which is not fair in case of tiny sensor nodes. The sequence used is to indict during environment, so solar cells are mostly used in these sensors. The energy reduction is also a significant constraint where frequently the sensors are deployed in remote areas.

Throughput: Number of packets process by node per unit time. The total number of bits received per second by the destinations of all the multi-hop flows in the network. The throughput is usually measured in bits per second (bit/s or bps). With this inputs different author proposed their ideas as like below:

Enam, et al [1] suggests clustering mechanisms which enable the sensor nodes to collect and aggregate data at nodes called cluster-heads in each cluster, and this avoids redundant data flow in WSN. In this way, clustering removes some overhead in terms of packet making, dealing out, energy consumption, and collision prevention, because cluster heads perform much functionality of sensors. The main common drawback of these proposals is that they build clusters before an event occurs in the field or follow the pre-event clustering approach and form clusters in the entire field. Intuitively, it brings significant overheads in terms of processing and energy. In the event-to-sink directed clustering approach, ESDC forms the clusters only when it is obligatory, so as to, as soon as an event occurs. The cluster formation process takes part in only the region in which event flow takes place, and does not go beyond that region to the whole network. Here, they assume that most of the time events are just occurring in some parts of the field being monitored. Accordingly, clusters are formed on the detection of an event and only in the direction of the minimum space to the sink. By means of the new event-to-sink and directed clustering notion, ESDC avoids the formation of unnecessary clusters in the network. Event-to-sink cluster setup also utilizes the spatial correlation between the nodes in the event detection area. Since ESDC considers the correlation between the sensor nodes in the event area, much less actual data has to be transmitted from the cluster to the sink. This way, energy dissipation and total overhead on the sensor nodes is reduced. Directed clustering is accomplished by selecting cluster heads to be the closest nodes to the sink. Hence, ESDC provides gain in energy, reduces packet transmission and processing overhead, and hence increases network lifetime.

Sandip Kumar, et al [3] proposed an energy-efficient routing scheme called Enhanced Energy-Efficient Protocol with Static Clustering (E3PSC), which is a modification of an existing routing scheme, Energy-Efficient Protocol with Static Clustering (EEPSC). Similar to EEPSC, the present work partitions the network into distance-based static clusters. However, unlike EEPSC, cluster-head collection is performed by captivating into version together the spatial allocation of sensors nodes in network as well as their remaining energy with a purpose to diminish the intra-cluster message overhead among the nodes making the scheme more energy-efficient. Both qualitative and quantitative analysis is performed to establish our claim of energy efficiency of the proposed scheme. A set of research is approved to assess the presentation of the system and to contrast the results with EEPSC. Based on our experimental results, it has been found that E3PSC outperforms EEPSC in provisions of network existence and energy utilization. In this paper, an energy-efficient routing scheme E3PSC for WSN is proposed. Similar to EEPSC, the present scheme partitions network into a number of distance based static clusters. However, in order to select cluster heads, besides considering only the residual energy of individual nodes, importance is given to the spatial distribution of the nodes aiming to reduce intra cluster communication overhead and making the scheme more energy-efficient. Efficiency of E3PSC is measured against EEPSC through simulation that validates the use of E3PSC in order to achieve improved network lifetime and reduced energy consumption.

Alper, et al [9] insisted concept behind this idea was to transmit data from sensor nodes, through its cluster head, to the sink in rounds. In each round a random cluster head selection mechanism is performed. At the start of each round, some of the sensor nodes elect themselves as cluster heads based on certain factors for e.g., the energy level, the number of times it has been selected as CH in the last rounds etc. Once a node is selected as a cluster head, it forms a cluster with its neighboring sensor nodes collect data from them and forward data to the sink. This process is done repeatedly in each round. Since no node is selected permanently as a cluster head, therefore the overall network energy consumption is distributed evenly among all nodes. The researchers have compared and intended a lot of energy-affecting constraint of the random cluster head selection protocols of WSN, but many of them have assumed the energy consumed in CH selection phases of these protocols as an ostensible factor. In this paper, the overhead extreme in the arbitrary cluster head selection phase has been calculated. It has been shown through general simulations that these stages consume 21-32% of the total network energy due to the transmission of control packets. The optimum number of CH has been calculated according to the minimum overhead energy consumption in cluster head selection phases. After that Setup Phase, Steady setup Phase and Data Transmission to Sink Phase are schedule.

Proposed Work

When event is occurred at that time whatever nodes are near to that event are get activated and they are responsible for transferring data from event to sink. At that time unnecessarily energy of nodes which are far away from the event occurred is get used. To avoid this, here, some sectoring scheme is made towards the nodes and wherever the event is occurred the nodes which are there in that sector are only alive others are in sleep mode and head of that sector collecting packets from other nodes which are near to the event. Though sector head is near to the sink end to end delay get reduced. This gives the more reliability. This proposes sectoring scheme to improve reliability for sector based wireless sensor network. In order to improve reliability, sensing region is separated into sectors and initial node of sector, which is near to the sink called as a sector head. MARS algorithm used for achieving reliability at highest. The Objectives of above work are:

1. Primary object of this invention is to provide a methodology to achieve the ultimate saving in energy during wireless communications in WSN where sectors or partition is made towards the nodes and wherever the event is occurred the nodes which are there in that sector are only alive others are in sleep mode and head of that sector collecting packets from other nodes which are near to the event.
2. Other object of present invention is to increase the Packet delivery ration and reduce the Packet loss ratio during communication in wireless sensor network.
3. Another object of present invention is to increase the Event reliability.
4. Yet further object of present invention is to make Decision making faster because of decentralize scenario locally
5. Yet other object of present invention is to achieve no dependency among sector heads, no congestion.

Detail Description of the Invention

Algorithm: Mechanism for adaptive Reliable Sectoring (MARS)

1. Division of sensor networks in ‘n’ number of sectors logically.
2. Assign sector head (SH) to node, which is nearest to sink.
3. Wherever event is occurred, activate current sector only, other sectors nodes are in sleep mode.
4. Nodes, which are there in event, occurred sector, transfer the packets to their respective SH within the event sector only.
5. SH, transfer the packets to sink.

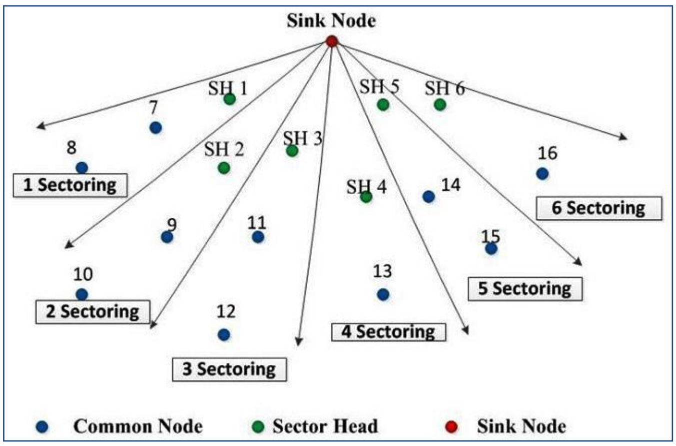

Fig. 2- Sectoring approach for reliable data communication

In [Fig-2], Suppose at first sector, event is occurred i.e. node number 8, then nodes which are near to the event occurred node they pass the information to the sector head 1 and then sector head pass information to the sink node. So simultaneously other sectors are in sleep mode if there is no event occurred.

Performance Analysis

Simulation Model and Environments

To support a wide range of simulations, our simulation code was implemented around NS-2 simulator. Our simulation models a network of 100 sensor nodes. General CSMA is used as MAC protocols and two-ray model is for propagation models. In the scenario Area of Sensor Field used is 1000*1000. Topology Used is Hierarchical. Size of the packet is 512 Bytes. Transmission Range of sending packets per second is 550. Number of sensor nodes used for taking reading is 40. Medium-access control protocol used for implementation is IEEE 802.11. Buffer occupancy to store all packets is 50.Routing protocol used is AODV (Ad hoc On-Demand Distance Vector). Simulation Time set for evaluation is 40 sec.

Simulation Results

[Fig-3] shows graph of packet delivery ratio (PDR) against node density with different sectors. Graph shows that for no sectoring scheme when node density is increases, PDR also increases because more number of neighbors occurs but from 50 to 75 node density increase PDR gets decreases because of more number of nodes more congestion occurred.

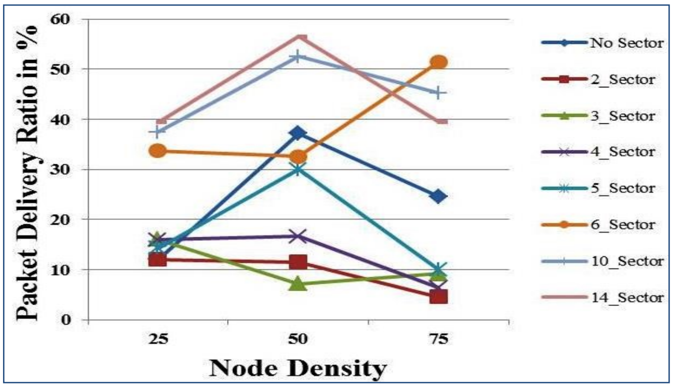

Fig. 3- Packet Delivery Ratio as a function of node density

For two sectoring scheme when node density is increases, PDR also increases because more number of neighbors occurs but from 50-75 node density increase PDR gets decreases because of more number of nodes more congestion occurred. For three sectoring scheme when node density is increases, PDR decreases because of more number of nodes more congestion occurred but from 50 to 75 node density increase PDR gets increases because more number of neighbors occurs. For four sectoring scheme when node density is increases, PDR also increases because more number of neighbors occurs but from 50 to 75 node density increase PDR gets decreases because of more number of nodes more congestion occurred. For five sectoring scheme when node density is keep on increasing, PDR decreases because of more number of nodes more congestion occurred. For six sectoring scheme when node density is keep on increasing, PDR also gets increases with more reliability because more number of neighbors occurs. For ten sectoring scheme when node density is increases, PDR also increases because more number of neighbors occurs but from 50 to 75 node density increase PDR gets decreases because of more number of nodes more congestion occurred. For fourteen sectoring scheme when node density is keep on increasing, PDR decreases because of more number of nodes more congestion occurred.

From above observations, performance for 75 node density is greatest as compare to other node density. So, next all results are calculated for 75 node density.

[Fig-4] shows graph of packet delivery ratio (PDR) against packet size with different sectors. Graph shows that for six sectoring scheme when packet size is keep on increasing; PDR is almost constant with more reliability. So, 6-sectoring scheme secure more reliability than others.

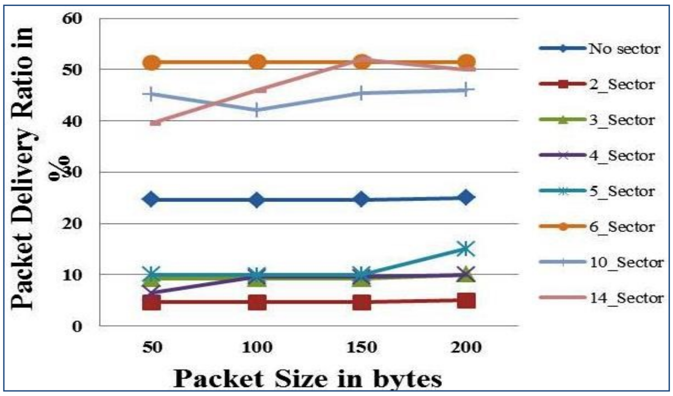

Fig. 4- Packet Delivery Ratio as a function of Packet size

[Fig-5] shows graph of packet loss ratio (PLR) against packet size with different sectors. Graph shows that for six sectoring scheme when packet size is keep on increasing; PLR is almost constant and with minimum value. So, 6-sectoring scheme secure less packet loss than others.

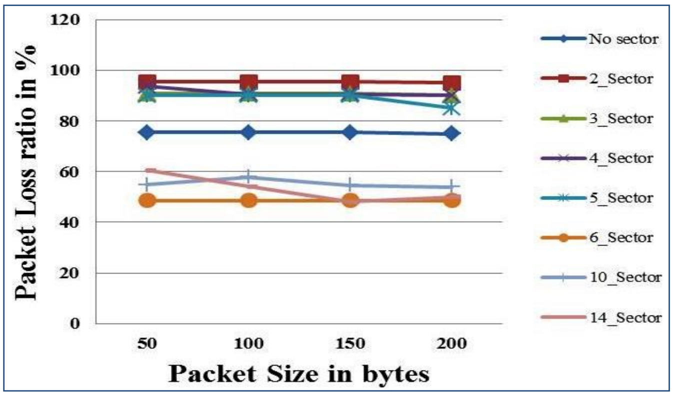

Fig. 5- Packet Loss Ratio as a function of Packet size

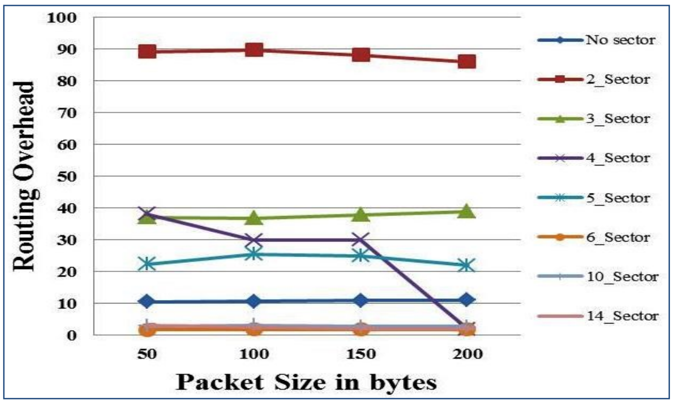

Fig. 6- Routing overhead as a function of Packet size

[Fig-6] shows graph of routing overhead against packet size with different sectors. Graph shows that for six sectoring scheme when packet size is keep on increasing; routing overhead is almost constant and with minimum value. So, 6-sectoring scheme secure less routing overhead than others.

[Fig-7] shows graph of delay against packet size with different sectors. Graph shows that for six sectoring scheme when packet size is keep on increasing; delay is almost constant and with minimum value.

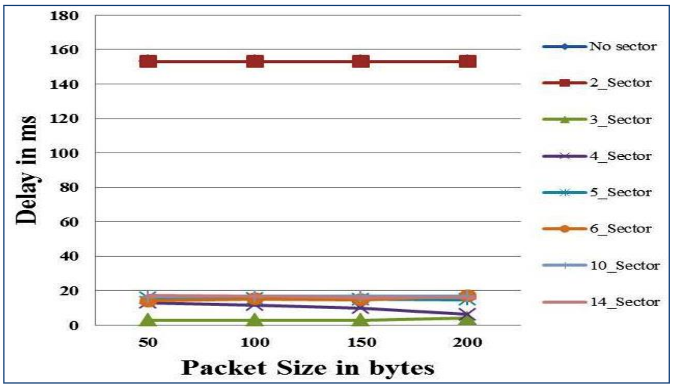

Fig. 7- Delay as a function of Packet size

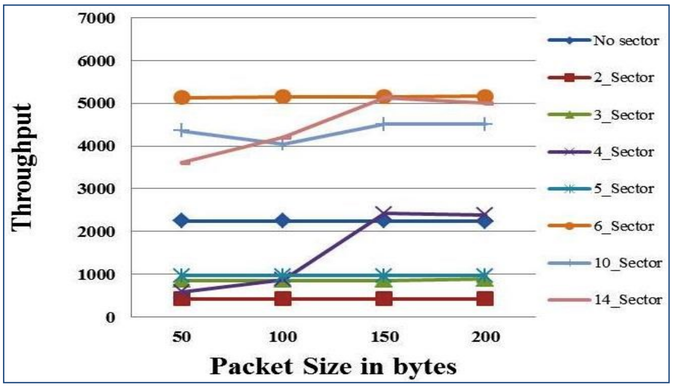

Fig. 8- Throughput as a function of Packet size

[Fig-8] shows graph of throughput against packet size with different sectors. Graph shows that for six sectoring scheme when packet size is keep on increasing; throughput is almost constant and with maximum value. So, 6-sectoring scheme secure more throughput than others.

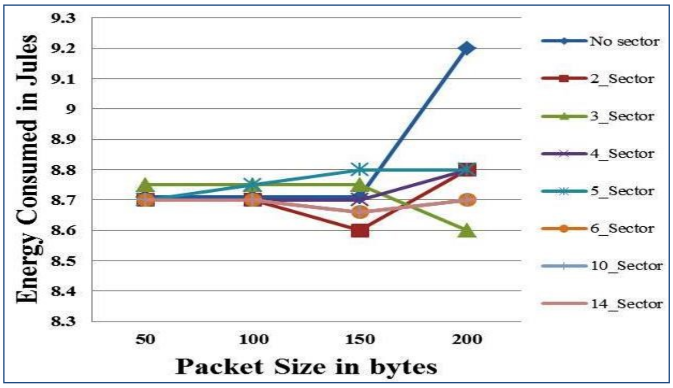

Fig. 9- Energy consumed as a function of Packet size

[Fig-9] shows graph of energy consumption against packet size with different sectors. Graph shows that for six sectoring scheme when packet size is keep on increasing; energy consumption is almost constant and with minimum value. So, 6-sectoring scheme almost secure less energy consumption than others.

Conclusion

The presented work, which leverages sinks to significantly extend the lifetime of the sensor network through the use of sectoring scheme. The proposed sectoring method gives more reliability i.e. 51.5%, throughput 5154 kb with less routing overhead i.e. 1.7, delay i.e. 14.9ms and minimum energy consumption i.e. 8.7 J when numbers of sectors are six and number of nodes are 75. The 6-sectoring scheme provides 50% improvement in packet delivery ratio, almost 100% routing overhead and delay decreases than no sectoring scheme. Nearly 50% improvement in throughput, according to results 6 sectoring scheme is superior to other sectors.

Conflict of Interest: None Declared.

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