Layer orient Time Domain Density Estimation Technique based Channel Assignment in Tree Structure Wireless Sensor Networks for Fast Data Collection

A.S.Syed Navaz [#1], Dr.G.M.Kadhar Nawaz [#2]

[1] Research Scholar, Prist University, Thanjavur, Tamilnadu, India
[2] Director and Professor, Department of Computer Application,
Sona College of Technology, Salem, Tamilnadu, India
[1] a.s.syednawaz@gmail.com
[2] nawazse@yahoo.co.in

Abstract - **The modern information technology has the back born running over wireless sensor networks, because the people uses various services through the wireless devices like mobile, PDA and so on. Many applications are running over the wireless sensor networks and could be accessed through wireless devices and can be applicable for many solutions. The purpose of deployment of WSN is for data collection on the battlefield or any situation in a rapid manner which requires fast and reliable data collection. The channel assignment also the primary factor while collecting information from different layers of the node. The concept of data collection has been discussed in many situations and suffers from the problem of data collection and channel assignment. We propose a novel approach which assigns channels based on layers in the tree structure wireless sensor networks to collect the data from WSN. The proposed layer based approach uses time division multiple access where the nodes present in each layer of the tree will be discreteto each time slot. The method computes the density at each layer based on the data available or transmitted at the previous transmission. The scheduling and channel assignment is complete at each time slot, and the one step layered nodes will be remainingto thecanal. This permits the transmission of the nodes could be approved outcontinuously, and the node which does not have channel assignment will continue idle.**

Keyword- Tree Structure WSN, Data Collection, Channel Assignment, Layer Based Channel Assignment.

I. Introduction

Wireless sensor networks are the collection of some nodes distributed in the different geographic region without any condition. The wireless sensor networks can be prepared in a rapid mannerin any situation which can be more useful in Warfield and battlefield which has very limited time and has to be practical in short time. The ultimate aim of deployment of wireless sensor network is to collect the information from various nodes of the wireless sensor network. We consider about the tree structure wireless sensor network where the nodes are absolute in tree form, and there may be N number of layer of nodes present in the network. In tree structure wireless sensor networks, the nodes has to perform data transfer from bottom to top to reach the cluster head so that to move towards the sink node. In the Tree structure WSN, the root node has to collect the information from the nodes of different layers of the network.

The wireless sensor network containerisprearranged ina rapid manner at different emergency situations like a battlefield. It is necessary to collect the information from various locations of war field. The coverage cost shows the effectiveness of synchronous transmission which has to be performed at each time slot so that all the nodes has to get the transmission slot. In a tree-based routing protocol, data collection is crucial, and a single node failure causessevere damages. Also, the data collection has to be performed at least time. The energy of the wireless nodes is the primary factor which affects the coverage cost and lifetime of the network.

In battlefield conditions, the sink node or the base station or control station has to collect the information about the battlefield at all the times. Based on the collected information, they have to take many battle decisions. Here how the data collection is performed is the challenge here in the tree structure WSN. In general, the time division multiple access is the protocol has been used in most wireless sensor networks. Tree MAC contemplates the modifications in load at unalike levels of a routing sapling and assigns time slots rendering to the depth. The hop count, of the nodes in the path tree, such that nodes earlier to the sink are allocated more slots than their offspring to mitigate congestion. Tree MAC operates on a single channel and achieves 1/3 of the maximum throughput, by receiving every three-time slots.

The channel assignment is the process of allocating the medium access to the nodes of the wireless sensor network. There are methods which assign the medium to the nodes based on round-robin approach or time division approach. There are methods which assign achannel to the nodes based on their data depth and sometimes the allocation is performed based on the priority of the data being available in the layers of the network.

In battlefieldconditions, the lower layer has the information about the real-timebattlefield condition and the node of the bottom layer has to be assigned to the channel at most prioritized manner. Also, the nodes of layer allocated with the medium have to transfer data to the next tier. Similarly, the nodes have to perform cooperativetransmission so that the packets can be reached to the cluster head or the sink of the network.

The layer based channel allocation can be an effective one, where the time division multiple access is not efficient due to the time complexity and inefficiency in the transmission of data. The layer based approach can be used at all the levels which have to consider various factors like the kind of information the sensor has and the amount of information it has and with the result of its previous transmission. Based on all these factors a layer of nodes will be assigned to the channel to improve the performance of data collection.

II. RELATED WORKS

There are many approaches has been discussed various situations, and we discuss few of them here in this section.

Dynamic cluster scheduling for cluster-tree WSNs [5], offerings anexplanation to enable these networks with the ability to self-adapt their collections' duty-cycle also scheduling, to provide enlarged quality of service to numerous traffic flows. Importantly, our method enables a network to change itsselectionprogrammingdeprived ofneedful long unreachability times or the re-association of the nodes. We show how to put on our practice to the case of IEEE 802.15.4/ZigBee cluster-tree WSNs without necessary changes to the protocol. Finally, we examine and prove the validity of ourtechnique through a complete simulation and new validation using commercially available technology in a Structural Health Monitoring application scenario.

An exact algorithm for maximum lifetime data gathering tree without aggregation in wireless sensor networks [6]evidence that, unless P = NP, no polynomial-time procedure can estimate the problem with a factor severely greater than 2/3. The result even grips in theparticularcase anywhere all sensors have the similar initial energy. Existing everything for the problematic focus on approximation algorithms, but these algorithms only find sub-optimal covering trees, and none of them can provideassurance to find thebest tree. We suggest the first non-trivial exact algorithm to find an optimal straddling tree. Due to the NP-hardness countryside of the problem, this proposed algorithm runs in exponential time in the nastiest case, but the spent time is abundant less than enumerating all straddling trees. This iscomplete by several methods for speeding up the search. Featured techniques include how to grow the initial spanning tree and how to divide the problem intosubproblems. The procedure can handle insignificant networks and be castoff as a benchmark for evaluating approximation algorithms.

Waves on small creations of tree-based wireless sensor systems [7], Epidemics on unimportant worlds of tree-based systems are studied, and the epidemic threshold at which the outbreak of the eruptionoccurs is intended. Epidemiological proceduresare inspected when the infection likelihood is larger than the filtrationline. Although dissimilar epidemiological processes occur on the underlying tree topology, the number of infected nodes increases exponentially as thediseasespreads. The same small-world network leads the unchanging vaccination procedure. The contagion still extends exponentially although the treatment reduces the prevalence speed.

Data Group In Tree-based Wireless Device Network using TDMA Preparation [8], labels the basic idea about the dissimilar methods of the data group in WSN. The cleanness of data is maintained as the process of data collection is as much faster as possible. Many existing techniques have the ability to manage with the subjects like energy ingesting, packet collision, retransmission, delay, etc. For quick data collection, schemes are obligatory to be scheduled inan efficient manner. One of the usefulmethods is TDMA. It is a kind of MAC fashionable contention-free average, allocating the period slots to links or nodes. In TDMA, the node develops active during only throughout the particular time slotassignedto it. Thus, it decreases energy ingesting with very less option of conflicts. It ropes the fair data collection in WSN with least delay and less amount of retransmission. Scheduling with TDMA can remain done with least schedule length and reasonableuse of bandwidth and time.

Node-based and Level-based scheduling [9], the preparation is done founded on the coloring of the unique network similar to conservative multi-hop scheduling algorithms forpure ad hoc networks. The nodes are colored corresponding to each slot with at least one packet are selected first, and other nodes are supplementaryafterward. In the Level-based arrangement, the original network is first renewed into a linear system where each node resembles a level in the originalsystem. The programming of the actual network is done by colouring the directsystem. This scheduling algorithm schedules conflict-free nodes associated with each level of the colour for the current slot and then plans additional nodes if possible.

Congestion-based scheduling [10] a programmingprocedure with TDMA, founded on mobbing rate of nodes. In congestion-based preparation algorithm, coloring the unique network is performed rendering to congestion gradation of the nodes and rest of the preparation is similar to node-based development or link-based scheduling. Leading, the level of congestion of each node is computed and compared. The node with the highest level of congestion is ordered first. The nodes with the same degree of congestion are colored with the same hue and transmit in same time slot. Other nodes are allocated with different color and time slot. It reduces the scheduling length which results in decreasing of overall delay.

BFS–Time Slot Assignment [11]: One solution to reduce programming length is assigning the same period slot to manifold links in such a way that those links can convey the data simultaneously. Each node assumed to generate data ata unique rate (one packet per second). Presents the BFS – Time Slot Assignment (allocating time slots in BFS manner) Algorithm for aggregated meet cast). In the absence of meddling links, the slot task is done in BFS method iteratively in each subtree.

Local While Slot Assignment: This preparation is for continuousrow dataconvergecast. Local time Slot Project (allocating time slots locally rendering to the requirement calculated at each node) for row-data touchcast. Hereone important thing to be cautious is the presence of interference. If the broadcast of the data takes residenceinside themeddling range, they cannot be scheduled in the same slot. Here we have to assume that the nodes which communicate their data concurrentlymust be out of meddling range of eachothers. Here, each node makes a constant quantity of data. Local time slot distribution can be over by choosing top greatest sub tree. The subtree with a large number of entire data packets (including children nodes) is named high most subtree and gets importance to convey. If a amount of packets remains same at all node, then the procedureassigns a slot to a chance connection.

All the above-discussed approaches have the problem of assigning the medium access control to the nodes of the layers in an efficient manner.

III. PROPOSED METHOD

The proposed method has a various stage of data collection namely Layer Orient Density Estimation, Layer Orient Time Division Channel Assignment, and Data Collection. We discuss each of the functional component detail in this section.

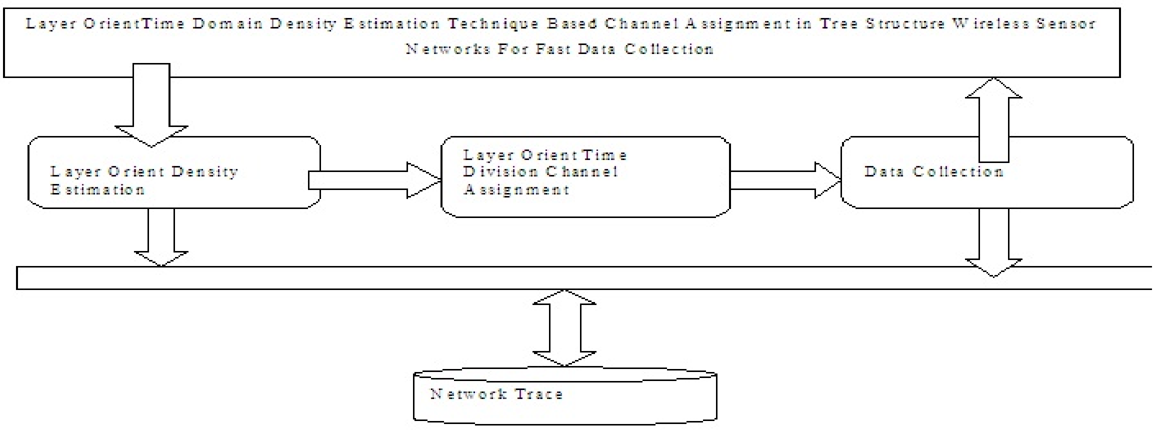


Fig. 1. Proposed System Architecture

A. *Layer Orient Density Estimation*

The layer orient density estimation is performed by using the network trace available in the root node or the cluster head. The group head computes the density of information present in each node found in the layer. The nodes present in each layer may have different size of data to be transmitted and requires a different time of MAC. The method identifies the number of nodes present in the each layer and computes the transmission density estimation. The computed transmission density value will be utilized in channel allocation process in the next stage.

Algorithm:

Input: Network Trace Nt, Layer L, Time T.

Output: Level Orient Transmission Data Density TDD.

Step1: start

Step2: Identify number of nodes in the layer L at Time Ti

$$Nn = \int \sum Nodes \in Li@Ti$$

Step3: computer transmission data density TDD.

$$TDD = \int_{i=1}^{size(Nn)} \frac{\sum TData(ni)}{size(Nn)}$$

Step4:Compute average channel utilization ACU.

$$ACU = \int_{i=1}^{size(Nn)} \frac{\sum Channel\ Utilization(Nt)}{size(Nn)}$$

Step5: TDD = TDD×ACU.

Step6: stop.

B. *Layer Orient Time Division Channel Assignment Scheme*

The layer orient channel assignment is performed based on time division multiple access where the time slot for each layer is computed based on data transmission density at different time window and the channel utilization. The method divides the time window into some tiny units and allocates the channel to the nodes of alayer based on the computed density estimation. At each time window, the method calculated the density estimation and based on that it allocates the channel to the concern layer and time unit will be dynamic in nature, and the channel will be assigned to the nodes of the layer.

Algorithm:

Input: Null

Output: Layer L.

Step1: start

Step2: for each time window Twi

For each layer Li from the network tree

Compute layer orient density TDD = LayerOrientDensityEstimation(Li)

Identify Number of nodes of the layer Nn = $\sum Nodes \in Li@Twi$

Compute channel requirement factor CRF = Nn×TDD

End

End

Step3: Compute average channel requirement factor.

$$ACRF = \frac{\sum CRF}{Numberoflayers}$$

Step4: Divide time unit by ACRF.

Step5: allocate each layer by $\frac{T}{ACRF}$

Step6: stop.

C. *Data Collection*

The data collection in a tree structure wireless sensor network is performed based on the layer orient time division channel assignment scheme. The method identifies the number of layers and number of nodes present in the layer. The method maintains the number of transmissions the node has performed and the data amount it has sent at each time window in the network trace. Using all these information we compute the layer orient density estimation and level orient time division channel assignment value which calculates the time should be allocated to the nodes of each layer. The nodes present in the layer can perform transmission at the assigned time unit only.

Algorithm:

Input:

Output:

Step1: start

Step2: for each time window

Perform layer orient Channel assignment scheme.

Assign the layers with the computed time.

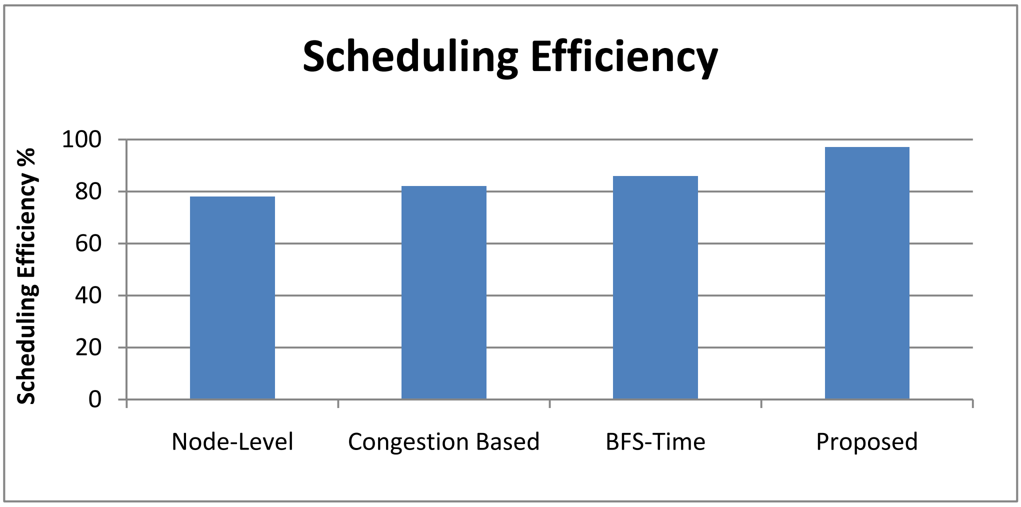
Perform data collection.

End

Step3: stop;

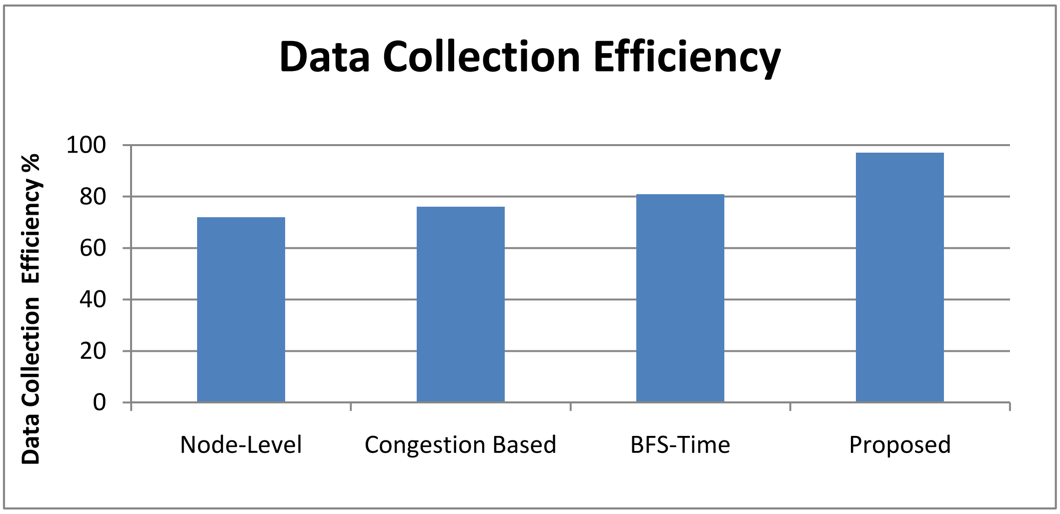
IV.RESULTS & DISCUSSION

The planned layer orient time separation channel assignment arrangement has remainedapplied and tested for its efficiency.The proposed technique has shaped efficient results in all the factors of channel utilization and data collection. The method has provided less time complexity and has produced useful results in QoS of data gathering in wireless devicesystems.



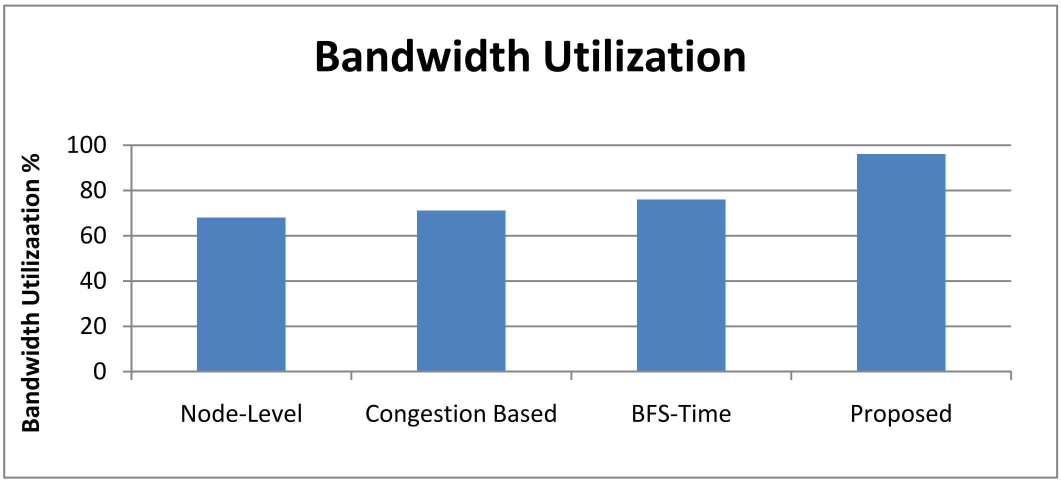
Graph 1: Evaluation of scheduling efficiency

The Graph 1, demonstrations the contrast of scheduling efficiency and the graph shows that the proposed method has produced a higher rate of programmingcompetence than additionalapproaches. In this graph shows the more than one method for schduling efficiency, compare to another method our proposed methos is give more schduling efficiency.



Graph 2: Evaluation of data collection efficiency

The Graph 2, expressions the assessment of data assortmenteffectiveness of different methods and it shows undoubtedly that the proposed method has shaped higher statistics collection efficiency than other methods. Also this graph shows the data collection efficiency in particular time. The figure 3, shows the contrast of bandwidth usage produced by variousmethods, and it demonstrations clearly that the plannedapproach has shaped higher use than other methods.



Graph 3: Evaluation of bandwidth utilization of dissimilar methods,

The graph 3, shows the comparison of bandwidth utilization produced by different methods and it shows clearly that the proposed method has produced higher utilization than other approaches.

V. Conclusion

We presented layer orient time field density approximation technique based channel assignment scheme for data collection in wireless sensor networks. The proposed method computed the time orient data density at each layer for each time window and based on that we calculate the channel utilization factor. Using both we approximation the time opening and its size required for each of the layers and the each segment is assigned to a different time slot to maximize the channel utilization.The proposed technique has produced well-organized results in scheduling and channel use and reduced the time complexity also.

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Authors Biography

A. S. Syed Navaz received his M.Sc in Information Technology from K.S.Rangasamy College of Technology, Anna University Coimbatore, M.Phil in Computer Science from Prist University, Thanjavur, M.C.A from Periyar University, Salem and Pursuing his Ph.D in the area of Wireless Sensor Networks. Currently he is working as an Assistant Professor in the Department of Computer Applications at Muthayammal College of Arts & Science. His areas of interests are Wireless Sensor Networks, Mobile Computing & Image Processing.

Dr. G. M. Kadhar Nawaz is a Professor and Director in the Department of Computer Applications at Sona College of Technology, Salem, India. He received his B.Sc in Computer Science and MCA from Vysya College, Salem, India in 1994 and 1997. He received his Ph. D from Periyar University, India in 2007. He has 15 years of experience in teaching and research. He has published more than 75 papers in reputed International Journals and Conferences. His research area is Network Security.