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Multi-channel and Effective Dynamic traffic allotment in Wireless Sensor Network

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Abstract-The remarkable benefit of WSN is that they improved the computation capability to physical circumstances where human presence is difficult. Because of more energy consumption the lifespan of the system wireless sensor network reduces. If the channel utilization is more than throughput of the system wireless sensor network reduces. Wireless sensor networks medium access control (MAC) procedures for system energy proficiency come from the cost of extra packet delay and limited throughput, since a sender is permitted to communicate in the short active periods, only. The proposed scheme reduces the traffic in the network using dynamic channel allocation. The duty cycle of the proposed network is also enhanced. As represented in experiment resultsthe duty cycle is reduced to 5% and energy efficiency is also improved to 3% as compared to i Queue method.

***Keywords*-Wireless Sensor Network, dynamic slot allocation, MAC, CSMA, TDMA, Queue length.**

I. INTRODUCTION

A Wireless sensor networks WSN [1] is composed of large number of sensor nodes which consist of sensing, data processing and communication capabilities. WSN sensors be able to sense vibration, electromagnetic strength, light, temperature, humidity, and so on, and transfer the sensed data to the new node complete a series of numerous in-between nodes that assistance to forward the data. WSN have sensing ability and communication functionalities. Recent advancement in wireless communication and electronics has enabled the development of low-cost, low-power multifunctional miniature devices for use in remote sensing applications [2]. WSN form a particular sort of wireless data transmission networks. The ultimate remarkable benefit of WSN is that they improved the computation capability to physical circumstances where human presences are difficult.

A research challenge in existing WSNs MAC protocols [3] is to make available more throughput and little delay, although maintaining low power ingestion. Short duty cycle [4] is all the time applied to expand the energy efficiency and network lifetime in WSN. The energy efficiency in WSN is key essential element for improved communication. The hardware condition is also good in WSN for better communication. If the channel utilization is more then throughput of the wireless sensor network reduces. Its drawback is extended delay and little throughput if traffic is more. The WSN traffic can be reduced because of dynamic channel allocation [5]. If energy efficiency and throughput improved then complete network performance also increased. Precisely following node request and dynamic distribution of time slots to data senders that have one or more queued packets. Precise transmission queue length i.e. load information with minimal overhead; Burst communication between nodes, for shortening the channel access delay; These features, predominantly provide the perfect information on the position of transmission queues, outcome in an extremely proficient protocol that, make available the finest performance to handle high traffic in WSNs.

WSN Medium Access Control (MAC) protocols for energy efficiency come from the cost of limited throughput and extra packet delay, meanwhile a sender is permitted to transmit in the small active time slot, only. Though, in typical applications, further in addition to short rate periodic traffic, similarly present burst traffic initiated upon event recognitions. As a result, there is an emerging necessity for a MAC protocol that adjusts its existing bandwidth to a dynamic traffic load.

The low duty cycle involves long delay [6] and limited throughput and the drawback is even greater under mutable traffic patterns. Some of the low duty-cycle MAC protocols offer great energy efficiency under the hypothesis that the network has long-term small rate intervallic traffic. Conversely, distinctive applications, in adding to little rate periodic traffic, too present rush traffic initiated upon occurrence detection. Accordingly, there is an evolving requirement for a MAC procedure that adapts its accessible bandwidth to a variable traffic load, i.e., retain light duty-cycle in low traffic situation and schedule more communication prospects when traffic upsurges, therefore the energy is simply applied for transport the application traffic each and every time needed. The protocols have more traffic overhead and more energy consumption.The MAC protocol should retain low duty-cycle in light traffic situation and plan additional transmission prospects when traffic upsurges so that the energy is simply used for transporting the application traffic at any time when needed. Accordingly, under great traffic load, the nonappearance of collisions makes them more efficient supportive high throughput.

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The rest of the paper is organized as follows. Section 2 provides a brief related work. Section 3 concentrates on the proposed work, and algorithms. Section 4 provides the implementation and result analysis. Finally, Section 5 provides concluding remarks.

II. RELATED WORK

Shuguo Zhuoet al. [7], recommended combined TDMA/CSMA MAC protocol termed i Queue-MAC for bursty and dynamic traffic. In this method if less traffic in a system then i Queue-MAC practices a contention-based CSMA appliance that delivers low delay with disseminated transmissions if traffic is huge and load is dynamic that it uses i Queue-MAC alterations to a contention-free TDMA instrument assigning transmission slots. The main step of i Queue-MAC is an effective closed loop control system that applies nodes' queue-length as the restrained output and applied adaptive time periods consignment as the control input to alleviate packets queueing. In circumstance, prior to i Queue-MAC, the analogous idea appeared into the FTT Flexible Time-Triggered prototype which is formerly recommended for Ethernet and CAN, i Queue-MAC makes it more suitable for WSNs.

A. Dunkels et al ContikiMAC [8] proficiently incorporates numerous unique methods of other MACs WSNs, such as phase-lock, burst progressing, and data packet strobe. Conversely, ContikiMAC is mostly considered to handle little rate packets, it has no particular system to handle high traffic loads.

Shantanu et. al.[9] the new IEEE802.15.4e and ISA100 standard are at present the utmost popular wireless solutions for industrialized applications. These standards make use of Time Slotted Channel Hopping (TSCH) method to make available deterministic robustness and transmissions. Conversely, at present, they nonexistence link setting up procedures which are critical for allocating frequency/slots resources in WSNs.

F.Osterlindetal.[10]Z-MAC applies hybrid TDMA/CSMA method for static slot distribution and diminishes traffic overhead. In this system unoccupied slot can be applied by others. Because of static and fixed slot allocation the bandwidth is compact. Strawman MAC diminishes the contention by applying additional collision data packets. The transmitter who has directed the lengthiest collision packet conquests the channel. But then the collision packets introduce an extensive quantity of disbursements to the network system. RCMAC improvements RI-MAC, that designates the subsequent sender via ACK piggybacking to decrease collision. Conversely, how to assign bandwidth amongst senders is not indicated.

Y. Sun, O. Gurewitzet al.[11] For continuance communication Wise-MAC a contention-based method and procedures, relates ”more-bit” data in the data packet header of messages. Receiver-initiated MAC RIMAC apply beacon as the ACK communication and subsequent progressing for uninterrupted transmission. Wise-MAC and RI-MAC have little throughput at high load for the reason that of collision amongst senders and receiver.

III. PROPOSED WORK

The proposed flowchart and algorithm is represented in this section. The flowchart of proposed algorithm is given in figure below.

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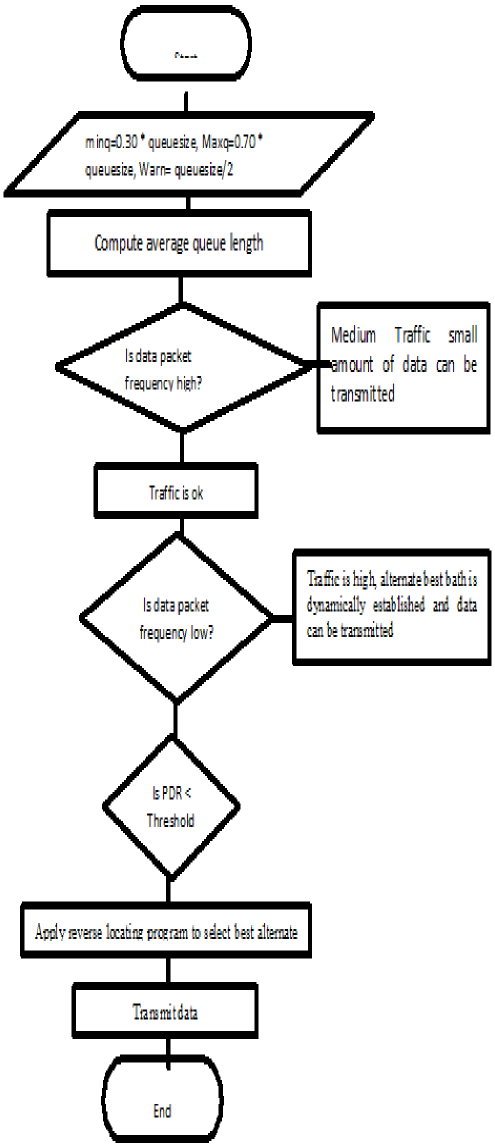

Fig. 1.Flowchart of proposed algorithm

Algorithm: Multi-channel dynamic traffic allotment and energy efficient algorithm

The multichannel dynamic trafficallotment algorithm is represented in section below. The algorithm used initialization parameter as input. The output of the algorithm is dynamic traffic allotment in multichannel environment.

Step 1: Initialization Sub-channel
Step 2: Channel Overhearing
Step 3: Channel selection
Step 4: Beacon overhearing
Step 5: Check sub-channel overlap
    If yes then
        Goto step 1
    Else
        Goto Step 4
    End if
Step 6: Sub-channel accessing
Step 7: Check PRP
    If PRP < p then
        Goto step 1
    Else
        Goto Step 6
    End if
Step 8: Init parameters
Sizeque= 50
quemin=0.30 * sizeque
quemax=0.70 * sizeque
Warnque=sizeque/2
Threshold value =0.70
PDR=80

Step 9) thechannel conditionand residual energy is tested by node to check the node status. The node checks its traffic condition with the assistance of designed average queue length provided in initialization. The condition of channel is checked by applying beacon ACK.

After testing frequency of beacon acknowledgment is high then

The channel status is Ok arriving traffic is very low, congestion status is OK no action is taken and data packets can be communicated

Else if beacon acknowledgment is medium, then congestion in traffic is low and neighboring nodes accomplish small data transmission

Else if beacon acknowledgment is low, very high congestion in network

Traffic is very high, data load is also huge, and substitute finest path is dynamically recognized

By checking beacon ACK and traffic load of neighbor, and data can be communicated

End if

Step 10) Test data packet circulation ratio of the WSN

If data packet circulation ratio dew drop to the given threshold value then

Starting from source node randomly choose the supportive node address of any one node neighbour

Send beacon REQ to the node

If any node reply beacon ACK from other than neighbor node then choose the reverse discovering

Mechanism and also transmit data packets if congestion status is OK

End if

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End

In initialization phase threshold values for queue length, packet number, packet delivery ratio is initialized for parameter testing. The routing protocol is set as LEACH, the number of nodes are set as 100. The maximum and minimum queue size is set quemax is set as 70% and quemin is set as 30% of queue length. Warning is half the queue size quemax+quemin/2

The residual energy of node with channel utilization condition is tested by every node to discover the node value. The node also tests its traffic congestion with the help of calculated average queue length. The condition of channel is tested by applying beacon acknowledge. If frequency of beacon ACK is high then congestion condition is very good the traffic status is very low, most of the data can be communicated otherwise if beacon ACK is medium, then congestion status in network traffic is low and neighboring nodes may transmits very less amount of data. Otherwise beacon ACK is low, represents very high congestion in system traffic status is very high, data load in node is also more, different path is dynamically activated by using beacon ACK and traffic load of neighbor, and information can be transmittedand test data packet delivery ratio of the WSN. If data packet delivery ratio dropped to the prescribed threshold value then source node randomly selected the different node address of any one node neighbour and send beacon REQ to the node If any node RPY beacon ACK from other than neighbor node then select the reverse route mechanism and also transmitsinformation if congestion condition is good.

IV. IMPLEMENTATION AND RESULT ANALYSIS

We have implemented dynamic sub-channel algorithm in MATLAB software. The experiment was performed in Intel i7 3.0 GHz machine, 8GB RAM. The implemented results represented that a proposed algorithm increases lifetime, energy efficiency and duty cycle of WSN.

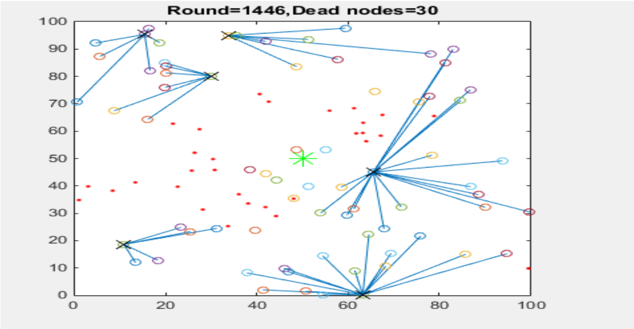

Fig 2. Dead node counts in round 1446

As represented in a figure 2 there is 30 dead node in 1146 rounds. It is represented that our method is more enegry efficient.

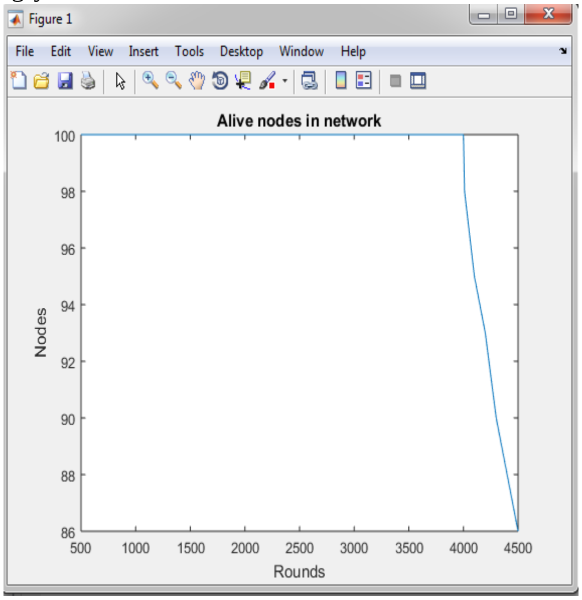

Fig 3: Alive nodes in a network

As given in figure 3 alive node status of system after each round. It indicates that the outcome is increased as compared to I Queue algorithm.

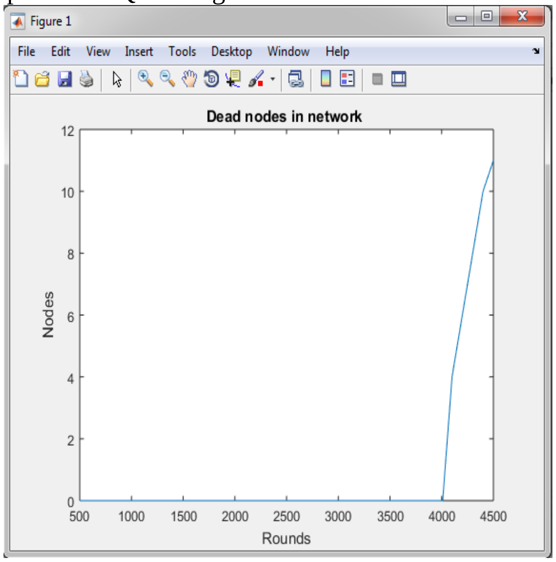

Fig 4. Dead nodes in network after each round.

Figure. 4 represent dead nodes in system after every round. It is given that first dead node found after many rounds which represents improvement in the energy and lifetime of the system.

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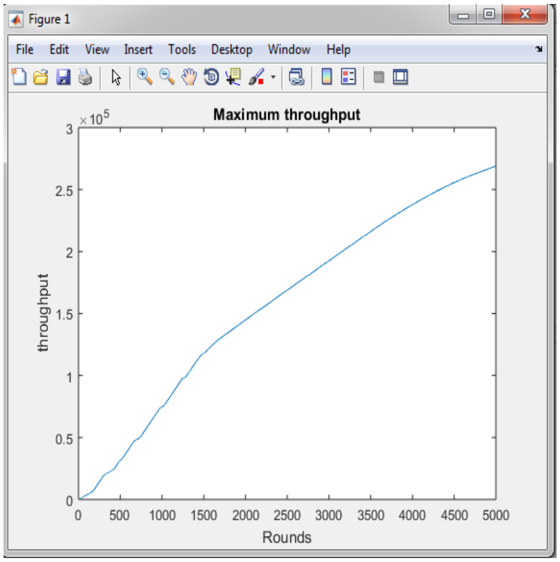

Fig 5: System throughput

As given in the figure 5 that throughput of the networkis improved as compared to iQueue method. The figure above represnted rounds and their throughput.

Table 1below shows the parameters for performance evaluation. The parameters used for performance evaluation are Minimum CP, packet size, slt size, mean subframe, queue size, max retry, and multichannel capability. As reprsented in table our method performance is better as compared to CoSens and iQueue methods.

The packet congestion objectives to dewdrop the packets or to clamp the resources such that the data transmission is affected.The packets sending capability of method is greater than before with epoch of interval. As equated to all the presented related methods the suggested scheme has the least possible packets drop ratio.

Table 1: Parameters for evaluation

	Proposed	CoSens	iQueue-MAC
Queue size	125 packets	180 packets	130 packets
Slot size	5 ms	5 ms	5 ms
Mean Subframe	600ms	600ms	600 ms
Minimum CP	15 ms	8 ms	15 ms
Packet size	126 bytes	120 bytes	120 bytes
Multichannel	Yes	No	Yes
Max retry	5 in CP	5 in WP	5 in CP

Table 2 indicates that the average duty cycle of method in implementation results as compared to iQueue and CoSens. As indicates in the table below the duty cycle in peak traffic time for iQueue is 17.842% and in CoSens method 27.383%.

Table 2: Duty cycle

CoSens	iQueue	Our Method
27.383%	17.842%	17.257%

Our method performance is 17.257% which is better as comapred to CoSens and iQueue method. As represents in Table 2 above, proposed method has the maximum proficient performance. This is because proposed method moving the rush traffic into the TDMA phase which is most proficient than contention-based communications.

V. CONCLUSION

The low duty cycle involves long delay and limited throughput and the drawback is even greater under mutable traffic patterns. Low cycle duty is every time applied to grow the system lifetime in WSN. If the system channel consumption is more than throughput of the sensor network diminishes. The low duty cycle and energy efficiency in WSN is key essential element for improved communication. The proposed algorithm improves the lifespan and duty phase of the wireless sensor network. The experimental outcomes represented the throughput of the system and end to end data transmission improved. The traffic of the sensor network reduced because of proposed algorithm and overall wireless system network performance is improved. The duty cycle is reduced to 5% compared to i Queue method.

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