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# ENERGY AWARE EFFICIENT CLUSTER BASED ADAPTIVE LOAD BALANCED NODE SCHEDULING SCHEME FOR COLLISION AVOIDANCE IN WIRELESS SENSOR NEWTWORK

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## ABSTRACT
Network lifetime persists as a significant requirement in Wireless Sensor Network (WSN) exploited to prolong network processing. Utilizing energy efficiently can significantly increase the lifespan of wireless sensor networks. An MRFO Based Cluster Head Selection was introduced selecting the best node as cluster head based on the fitness value for enhancing the energy consumption and network lifetime. The adapted, scalable and integrated method with Adaptive Load balanced Node scheduling is proposed in this paper. Load Balanced Node scheduling is one such strategy that can prolong the lifetime of WSNs and also helps to avoid the data collision. Each sensor node in the network correctly determines its mode of operation using adaptive Kalman Filter. This Filter considers the buffer size and energy parameter of each sensor node for adaptive node scheduling. Based on these parameter, it allocates the time slots to each node. The proposed method reduces the energy consumption of the individual node effectively. It also reduces the network delay by considering the load balanced node scheduling. The simulation is demonstrated that the proposed scheme is effective compared with existing scheduling scheme in terms of end-to-end delay, energy efficiency and Packet delivery Ratio, Packet Loss Ratio.
**Keywords-** Scheduling, Load, Collision, Buffer , Cluster

## I.INTRODUCTION
The Wireless Sensor Network (WSN) remains a well-known wireless technology since it has multi-disciplinary applications. It comprises of Base Station (BS) and a high quantity of spatially dispersed sensor nodes. Wireless Sensor Network (WSN) is a network that senses data from the environment and is designed to collectively perceive, gather, communicate, and manage data from observed things within the network.[1]

The network's performance will suffer if the energy of sensor nodes is not adequately utilised. Also, it is important for the sensor nodes to co-operate with one another in WSN in order to maintain the self organizing nature of the network. The modules used in sensor nodes also need to be effective so as to consume minimum energy to assure maximized lifetime for the network.

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Random deployment of sensor nodes inevitably triggers collisions during message exchanges [4]. In a cluster based data aggregation, the cluster members should transmit the collected data to the cluster head in a collision free manner with reduced power consumption. To save energy, sensors usually manage multi-mode sensing operations, in which they periodically switch between active and inactive periods[2]

Node scheduling is one such strategy that can prolong the lifetime of WSNs and also helps to balance the workload among the sensor nodes. Hence efficient scheduling techniques should be applied while aggregating data at the cluster head. Scheduling mechanisms control the transmission process by indicating which packets must be transmitted and which packets must be dropped. The main objectives of scheduling techniques are to reduce the collision among the flows and conserve energy.

In order to deal with energy consumption problem in WSN , Cluster based routing methodology [5] was projected by means that Distributed energy evaluation approach. This methodology uses Cluster head selection strategies considering only energy of the node But, the matter of energy consumption are increased in network. So, Optimization based CH selection(MRFO)was proposed to enhance and recovering the problem of Energy consumption. In MRFO, Cluster formation is achieved using Euclidean Distance measure. Then selecting suitable Cluster using MRFO using fitness function. After that data are aggregated from cluster member and transfer to the base station and neighbour node which improved the performance of Cluster based routing .

In this paper, Efficient Load Balanced Node Scheduling adapt the Adaptive Kalman Filter for efficient node scheduling. In EEALBNS, the Adaptive Kalman filter schemes used based on the Residual Energy Level , Buffer Factor and Coverage Rate to make decision on the node scheduling process is achieved.Nodes state measurement and observation measurement are calculated for the node scheduling using kernel values. However, the network energy consumption was high which causes network lifetime. Load balanced node scheduling procedure is established in order to avoid unnecessary energy consumption. Thus, this technique reduces both congestion and energy consumption in the network efficiently.

The rest of the article is structured as follows: Section II presents the literature survey related to the scheduling techniques in WSN. Section III explains the proposed methodology. Section IV illustrates the experimental results of the proposed mechanism. Finally, Section V concludes the research work.

## II.LITERATURE SURVEY

**Kozłowski et al [3]** proposed an Energy Efficient Duty Cycling(EEDC) method for node Scheduling. This method considers the delay and duty cycling of nodes. It schedules the slot for each node energy used up for the transmitting and receiving the sensor nodes. It divided the schedule slot into three parts that are transmission, receive and listening nodes. These slots are obvious based on the energy consumed for ach transmission and reception of the sensor network.

**Bahbahaniet.al.[4]**Proposed an Cooperative time division MultipleAccess

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Scheduling(cTDMA)Method for node duty scheduling.This method divide the duty slots into tow parts that are direct transmission sub slot and copperative transmission sub slot.In direct transmission sub slot the active sensor node send its packets to the sink and cooperative nodes whereas cooperative transmission sub slot the relay nodes are transmitted their packet.the cTDMA cannot support the dynamic changing of slots in scheduling.

**Chen et al[5]**proposed an Reinforcement based sleep scheduling for coverage (RLSSC) method for node scheduling using Q-learning.The traditional approach has been used for duty schedule the actions of sensor nodes.This method has two process for scheduling.In the first step it has notified the coverage redundancy among sensors nodes.Secondly,sensor nodes wants to know the best action depend on Q- Learning.

**Zhang et al[6]** Proposed an adaptive slot scheduling with Q-learning for node duty scheduling with high efficiency. Due to the convergence nature, the scheduling fastly approaches an approximate optimal sequence along with the execution of frames.

**Neamatollahi P et al[7]** Proposed an Dynamic Hyper Round Policy (DHRP), which schedules clustering-task to extend the network lifetime and reduce energy consumption. Energy-efficient Data Collecting (SEDC) protocol is also proposed to evaluate the usefulness of DHRP and calculate the end- to-end energy consumption.

**Palaniappan et al [8]**Proposed an Efficient Multi Attribute Time Slot Scheduling method for duty scheduling the Sensor nodes. The method is focused to extend the lifetime of sensor nodes with multi part dynamic routing (MPDR) neighbour conditions and previous time slot conditions. Based on both the values the node has been scheduled as sleep/wakeup mode and this will be performed for each time slot. The selection of node is performed according to the condition of neighbour nodes and energy parameter by sharing the information between them.

**Vijayalakshmi et al[9]** Proposed an Cluster based Mobile Data Gathering technique using space division multiple access and particle swarm optimization (PSO) techniques.In this Proposed method the sensor huns are isolated into groups. Mobile data collectors (MDC) are organized with numerous antennas which operate on SDMA technique. To schedule visiting locations of MDC, anchor points are selected using PSO algorithm.

## III.PROPOSED METHODOLOGY

Nodes are deployed in the particular area with Base Station. After that Cluster are formed using Pythagorean Euclidean Method and select the Best node in the group as Cluster Head using Fitness Value. MRFO Evaluate the fitness value based on five objective (Energy, Proximity, Communication Cost, Distance between Node and BS, Coverage) and Select the node as Cluster Head. The Proficient MRFO method are fed to EEALBNS. The EEALBNS Method allocate the time slots to the schedule the node states as sleep, active, transmit. It enhances network lifetime order to avoid unnecessary energy consumption.

The Cluster head assigns timeslots to its joined sensor nodes with the help of STDMA. The STDMA acquires the sensor node's statistical information i.e., Node ID,Energy and Buffer. Each node runs the Adaptive Kalman filter, and the report is forwarded to the CH. The CH then turns on the mode for each cluster node. Once all the information are obtained from each sensor

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node, the cluster head evaluates this statistical information and assigns dynamic timeslots to each sensor node for data transmission. This proposed technique comprises of Load balanced Node scheduling strategy to deal with energy consumption due to the allocation of timeslots for data transmission.

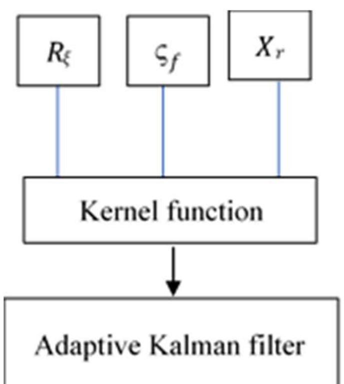
**Assessment of kernel Function**

The Proposed Scheduling algorithm takes Residual Energy Level $R\xi$ , Buffer Factor □$f$ , and Coverage Rate $Xr$ to make decision on the node status. In this, Cauchy Kernel Function is used for non-linear cases.The Adaptive Kalman filter is executed by each node and the report is sent to the CH. Then, the CH activates the mode for each node in the cluster. $R\xi$, □$f$ , $Xr$

The kernel function is defined as,

$$\delta_N(e) = \frac{1}{1+\frac{e^2}{N}} \qquad (1)$$

Where $e$ is the exponential term between two different variables and □ is the dynamic kernel bandwidth and □ range between 0 and ∞. Adaptive  alman filter gives the optimum solution for both linear and non-linear cases.




**Conception of adaptive Kalman Filter**

Based on the state measurements and observation measurement Kalman filter is formulated.

$$X_{t=} f_t X_t + a_t \quad (2)$$

$$Y_{t=} h_t X_t + b_t \quad (3)$$

Here, xt is a state measurements and , yt is a observation measurements at time t. ft is a state transition matrix whereas ht is a observation matrix respectively, at denotes observation noise value and bt is a gaussian noise.

The probabilistic model is represented as

$$\rho(Y|X_t)=\text{N}(y_t|\text{h}X_t,\text{a}) \quad (4)$$

$$\rho(X_t|X_{t-1})=\text{N}(Y_t|\text{f}X_t,\text{b}) \quad (5)$$

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The threshold value for each metric is set by the tsails entropy and nodes having the values above the threshold value are set to active mode whereas other nodes are set to sleep mode which will be changed periodically.

| | | | | | |
|---|---|---|---|---|---|
| T | S | A | S | A | T |

S1-------------------- T-Transmit

| | | | | | |
|---|---|---|---|---|---|
| S | T | A | S | A | T |

S-Sleep

S2------------------

| | | | | | |
|---|---|---|---|---|---|
| T | S | A | T | A | S |

A-Active

SN------------------------------

Fig 1:Adaptive scheduling using EEALBNS

The entropy condition is expressed as,

$$T_y(x_i)=\frac{h}{y-1}\left(1-\sum_i x_i^y\right) \quad (6)$$

In which, y is the entropy and $thy$ is the threshold value. Through this method allot the dynamic timeslot in order to improve the energy efficiency of the network, avoid the data collision between sensor nodes

**Load Balanced Node Scheduling(LBNS)**

The process of assigning timeslots is performed as follows:

Each sensor node transmits a Type-I Message to the Cluster head.This packet consists of different information i.e., node ID, battery information, location information, propagation time,and kernel values

Then, the Cluster head assigns scaled value to each sensor node on the basis of distance and the information obtained in Type-1

Once the scaled value for each sensor node has been determined, Type-II Messge is used to broadcast this data throughout the network. The node ID, data transmission start time, scheduling details, and dynamic timeslots are all included in this new message

Based on the receiving Type-II broadcast message, each node becomes an aware of each sensor node's information to transmit the data packets without any collision

This process keeps going until the last network node has finished transmitting all of its data.

**Algorithm: ENERGY AWARE EFFICIENT ADAPTIVE LOAD BALANCED NODE SCHEDULING SCHEME**

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Step1:Random Deployment Of Sensor Nodes

Step 2:Bootsrap And Network Setup Process

Step 3: Cluster Formation Is Generated Based On Sensor Nodes Distance.

Step 4: Cluster Head (Ch) Selection Is Performed Based Fitness Value

Step 5: The Fitness Values Are Calculated Using Proficient Manta Rays Foraging Optimization Techniques.

Step 6: After Finding The Best Cluster Head Node Adaptive Scheduling Process Begin

Step 7:Each Node Execute The Adaptive Kalman Filter And Calculate The Kernel Values(Based On Residual Energy And Buffer Factor, Coverage Rate) Send The Value As Type I Message

Step 8:Cluster head assign the time slot based on the type 1 message and send the timeslot details as type II message to all the node in the cluster. This message consists of node ID, starting time of data transmission, scheduling information, dynamic timeslots.

Step 9:Every node becomes an aware of each sensor node's information to transmit the data packets without any collision

Step 10:This Process Keeps going until the last network node has finished transmitting all of its data

**RESULT AND DISCUSSION**

The parameter for simulating the network and the evaluation parameters are explained in this section. The proposed EEALBNS is compared with the existing protocols CTDMA in terms of energy consumption, PDR, packet delay, and packet drop ratio. The parameter list used for simulation is listed out in Table 1

| Parameters | Value |
|---|---|
| Number of Node | 50,100,150,200 |
| Initial energy | 0.5 |
| Size of hello packet | 25 bytes |
| Node Placement | Random |
| Packet Size | 12bytes |
| Routing Protocol | DSR |

**Energy consumption**

It refers to the amount of energy consumed by each node during packets transmission. Energy consumption of a sensor is based on sensing, computing and communication.

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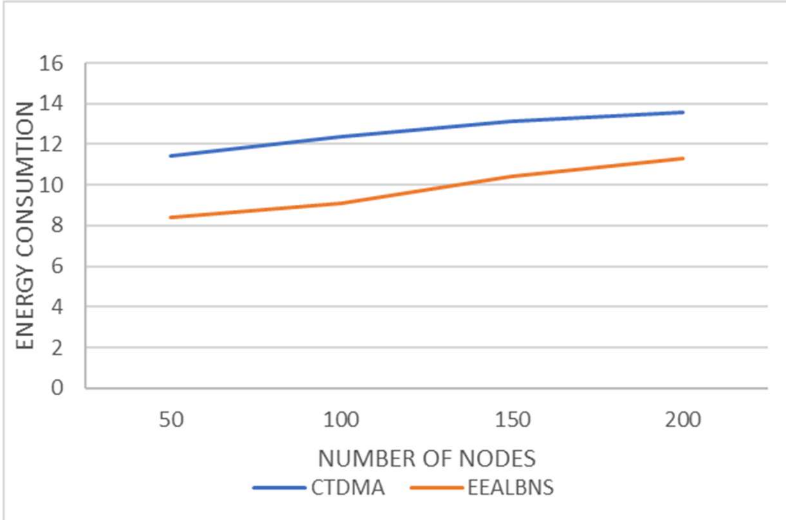


Fig 2:Comparision of Energy Consumption

From the Fig 2 analysis, it is observed that the proposed EEALBNS technique has consume less Amount of energy because the adaptive node scheduling strategy to transmit the data successfully without any congestion to the allotted timeslot

**Packet Delivery Ratio(PDR)**

Packet Delivery Ratio shows the data transmission reliability. PDR is the ratio of actual packets successfully received by the sink to the total packets sent by the source in a network

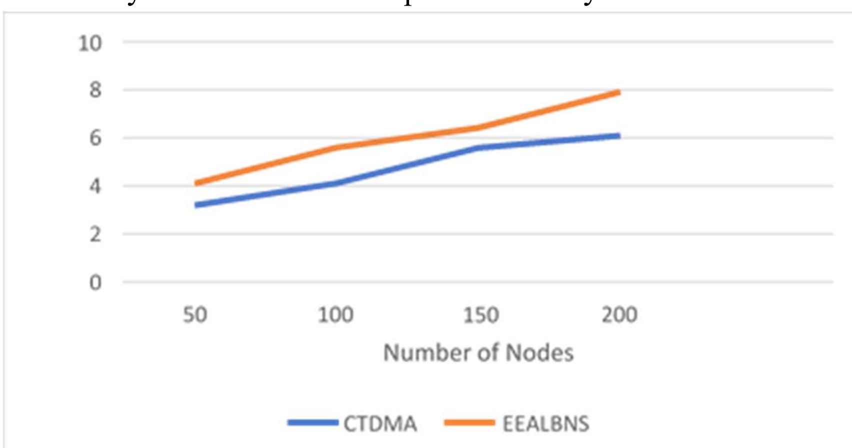


Fig 3:Comparision of PDR

Figure 3 compares the Packet delivery ratio against the number of nodes for the existing CTDMA and the proposed EEALBNS technique. In terms of Packet delivery ratio, the proposed technique shows effective results compared to the existing Scheduling Techniques

**Delay**

It defines the time between generation of data packets and reaching the destination.

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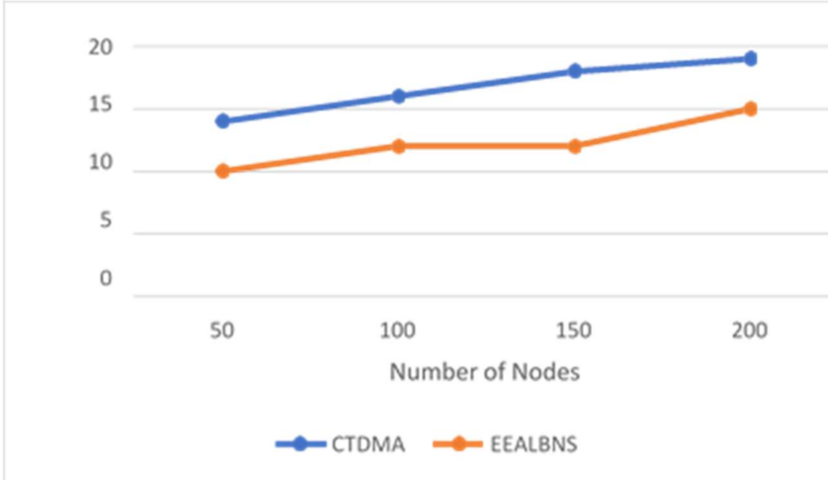


Fig 4:Comparision of Delay

Figure 2 compares the delay against the number of nodes for the existing CTDMA and the proposed EEALBNS method. It can be inferred from the figure that the routing delay increases as the number of nodes increases. Also for any number of nodes when contrasted to the existing one, the proposed EEALBNS shows less delay for the data routing.

**Packet Drop Ratio**

It measures the ratio of the total packets dropped to the total packets transmitted in the network.

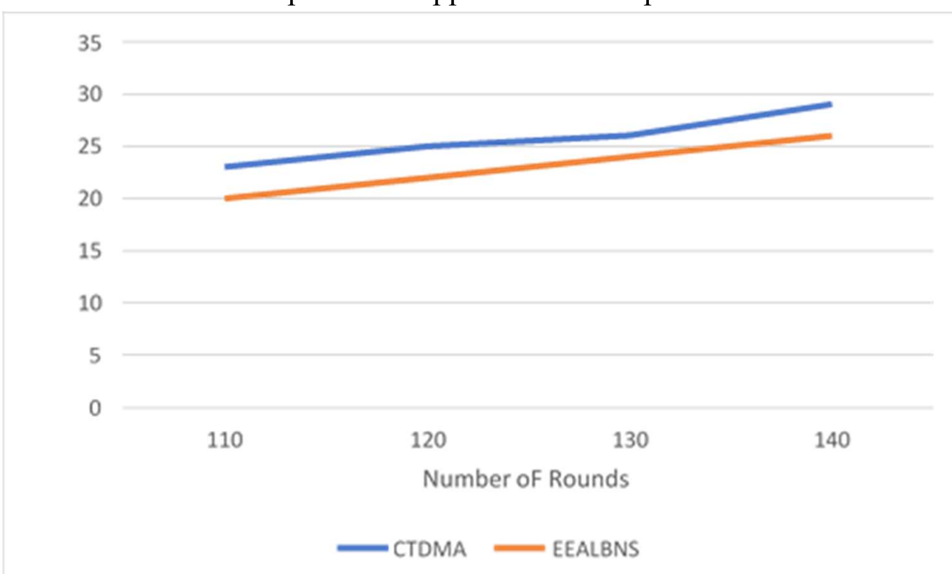


Fig 5:Comaprision of Packet Drop Ratio

Figure 5 Demonstrated the packet drop ratio as % under the different number of rounds in EELBNS and CTDMA. It is obvious that the Proposed EEALBNS has less packet drop ratio than the other scheduling Techniques.

**CONCLUSION**

In this Paper Adaptive Load balanced Node Scheduling(EELBNS) technique is proposed to avoid the collision by minimizing energy consumption through the network. In this proposed

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technique, dynamic timeslots for each sensor node are allocated by adaptive Kalman filter which is performed based on the significant factors. In this mechanism Cluster Head node to allocate the dynamic timeslots for each node by computing the kernel value of each node. This kernel value is computed according to the node's statistical information like Energy, memory and coverage. After that, the data packets are transmitted to the destination node successfully during the allocated timeslots without any congestion. Thus, this technique reduces both congestion and energy consumption in the network efficiently. Finally, the simulation results prove that the effectiveness of the proposed adaptive Load balanced Node scheduling technique compared to the existing technique.

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