Energy Efficient TDMA and Secure based MAC Protocol for WSN using AQL Coding and ASGWI Clustering

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Research Article

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Energy Efficient TDMA and Secure based MAC Protocol for WSN using AQL Coding and ASGWI Clustering

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Abstract**—**This work presents a Secure and Energy Efficient TDMA based MAC Protocol in Wireless Sensor Networks. The presented technique is handled in the following stages. In the initial phase, adaptable step size grey wolf inspired (ASGWI) clustering methodology is presented for producing viable cluster trees by optimal selection of cluster heads. The ASGWI clustering decreases the expense of finding the ideal situation for the head hubs in a cluster. In the second stage, reliable routing is provided by the adaptive quantum logic (AQL) coding to advance the system security in WSN. At last, the energy effective secure information correspondence approach is proposed inside the cluster instead of the base station for TDMA scheduling. Here, the determination models of the objective function are created dependent on the remaining energy, Headcount, intra-cluster distance, and node degree. The presented TDMA scheduling for Cluster-tree topology in WSNs meets the practicality and the energy demands. The exploratory outcomes show the predominance of the introduced approach contrasting and the current strategies regarding network throughput, end-to-end delay, packet delivery ratio, and the remaining energy level of the nodes.

Key words: - Clustering, Scheduling, Network security, Energy measure, Reliable routing

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1. INTRODUCTION

The usage of wireless sensor networks (WSNs) in different industrialized applications comprising checking and control frameworks, and with the way that sensor hubs are generally battery fuelled, energy-effective Medium Access Control (MAC) conventions are getting more required Additionally, different necessities of modern applications, for example, idealness, power, and on the fly arrangement and setups are fundamental [1-4]. The MAC conventions dependent on Time Division Multiple Access (TDMA) beat MAC conventions dependent on Carrier Sense Multiple Access (CSMA) as uncovered. The TDMA technique cuts the time area (i.e., the time of the timetable) into equivalent estimated schedule openings, and hubs are doled out a legitimate number of timeslots pertinent to the payload of the information to be sent by the hub [5, 6]. The hubs are in rest mode until their dispensed schedule openings to spare energy. Since TDMA booking calculations wipe out the crash event and look for limiting the quantity of timeslots allocated to every hub, the energy utilization of the hubs is decreased. Besides, with the best possible requesting of the assigned time allotments, the transmission postponement can be essentially decreased [7, 8].

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Medium access control (MAC) convention has been focused to beat the issue, for it assumes an altogether significant function in energy the board of hubs in WSN. Numerous dispute MAC conventions are proposed for WSN to improve the presentation [9], the majority of which depend on transporter sense different access/crash avoidance (CSMA/CA) plot. In any case, these conventions are intended for little scope networks with under 100 sensor hubs. In enormous scope networks with in excess of 100 sensor hubs, the conflict based MAC conventions lead to a high crash rate [10]. Then, some other designation and participation based conventions, for example, introduced in [11], are proposed on the establishment of TDMA conspire, which can really take care of the crash issue in huge scope organizations. However, in little scope organizations, these conventions lead to a misuse of opening assets and lessening throughput. Also, some cross-layer or half and half conventions intended to improve energy productivity by joining the benefits of both dispute and assignment conventions [12, 13]. Sadly, these conventions predominantly centre on improving the presentation of static WSN rather than versatile WSN [14, 15].

In particular, in WSNs, TDMA-based MAC conventions are regularly utilized in situations where practicality is required [16]. The information accumulation booking (DAS) works by developing a conglomeration tree established at the sink and the space apportioned to a parent is carefully more noteworthy than the opening of any of its youngsters. Accordingly, a parent hub will engender accumulated data in the wake of gathering messages from the entirety of its kids [17]. A new low force with predominance of administration certain medium access control technique is an intellectual Hybrid MAC (IH-MAC) method for remote sensor networks [18]. The overhead half and half MAC conventions based on this examination are communicated with the assistance of strongly researching CSMA and TDMA and presented a cross breed Energy powerful unique coordinating system for traffic versatile remote sensor organizations. The fitness of the extended MAC method can be explored with the assistance of copying and connecting the arrangements with comparative winning examinations [19]. The primary contributions of this paper areprécised as follows,

- Adaptable step size grey wolf inspired (ASGWI) clustering is utilized for the optimum locating of head nodes in a cluster.
- Adaptive quantum logic (AQL) coding is utilized to advance network security in WSN.
- Secure data communication is accomplished using presented TDMA scheduling. Here, Node degree, residual energy, headcount and intra cluster distance processes are utilized for the security enhancement.

The structure of the manuscript is made as searches after: Section 2 overviews the papers with respect to the introduced strategy. In section 3, concise clarification of the introduced approach is specified, section explores the reviewing results and section 5 completes the manuscript.

2. RELATED WORK

Muhammad Rusyadi Ramli et al. [20] introduced a novel convention named HP-MAC, a half and half MAC convention for information gathering in a UAV-WSN. The proposed conspire works by setting the UAV to occasionally send a reference point edge to sensor hubs so as to advise its quality, at that point, every sensor hub that gets the signal casing fights to send an enrollment casing to the UAV. A subsequent reference point outline at that point communicated by the UAV to the enrolled hubs with respect to their transmission plan. HP-MAC utilizes CSMA/CA during the enrollment cycle of the sensor hubs and dispenses the enlisted sensor hubs time allotments in the information gathering measure.

Mohamed Elshrkawey et al. [21] presented an improvement way to reduce energy utilization and expand the organization's lifetime. It has been refined by expanding the energy adjusting in groups among all sensor hubs to limit the energy dissemination during network interchanges. The improved technique depends on a group head determination strategy. Moreover, an improved timetable of the TDMA has been actualized. At long last, the advancement approach shows the advancement as far as organization lifetime, Number of group head, energy utilization, and number of parcels moved to BS contrasted with LEACH and other related conventions.

Chunlin Li et al. [22] introduced a way to deal with augment the weighted total calculation rate by joint enhancement of framework assets the board and undertaking registering time allotment. To tackle the streamlining issue, an alternative direction multiplier strategy based circulated advancement technique was proposed. The proposed strategy can break down the advancement issue into N sub-issues. Test results show that the proposed strategy beats the benchmarks and significantly expands the weighted aggregate calculation rate while keeping the energy utilization at a low level under the reason of time unpredictability.

Jack Kirton et al. [23] presented a traffic annoyance to changing the steering convention can be accomplished at the connection layer through the task of time allotments to hubs. The introduced paper takes care of a multi-target advancement issue where SLP, plan inactivity, and last aggressor separation are measures. They utilized hereditary calculations to produce Pareto-ideal timetables utilizing two wellness standards, inspecting the Pareto productivity of choosing either and affirming the proficiency by performing reproductions which show a close to ideal catch proportion.

Vinu Sundararaj et al. [24] presented an Energy Efficient Dynamic Scheduling Hybrid MAC Protocol (EDS-MAC) for Traffic Adaptive Wireless Sensor Networks. The proposed approach comprises of two phases, (i) group development, and (ii) information transmission. In the primary stage, a variable advance size firefly calculation is proposed for creating energy dependent groups by ideal determination of cluster heads. This diminishes the expense of finding the ideal situation for the head hubs in a group. Also, they presented methodology inside the bunch instead of base station, which makes it a semi disseminated technique. The choice models of the target work depended on the remaining energy, intra-bunch separation, hub degree and cluster heads.

Muhammad Aslam et al. [25] proposed Two energy-efficient path planning routing protocols, Two-Hop heterogeneity-aware Centralized Energy Efficient Clustering (THCEEC) and advanced heterogeneity-aware CEEC, were suggested for three level heterogeneous WSNs (ACEEC). Both of these methods are adapted from Centralized Energy Efficient Clustering (CEEC) in different ways to deal with network deployment fluctuations and WSN adopting transmission ranges. By evaluating beginning energy, residual energy, regional flag, and distance to the BS, BS uses THCEEC and ACEEC routing protocol algorithms to determine suitable Cluster-Heads (CHs).

3. PROPOSED METHODOLOGY

A Secure and Energy Efficient TDMA based MAC Protocol in WSN is introduced. At first, ASGWI clustering methodology is presented for creating powerful gathering trees by ideal choice of cluster heads. Afterwards, reliable routing is provided by the AQL coding to advanceto improve the organization security in WSN. At last, the energy productive secure information correspondence approach is proposed inside the cluster for TDMA planning.Here, the effective estimates, for exampleresidual energy, Head count, intra-cluster distance, and node degree are utilized to progress the TDMA planning. The presented TDMA scheduling for Cluster-tree topology in WSNs sees the timeliness and the energy demands.The schematic representation of proposed methodology is given in figure 1.

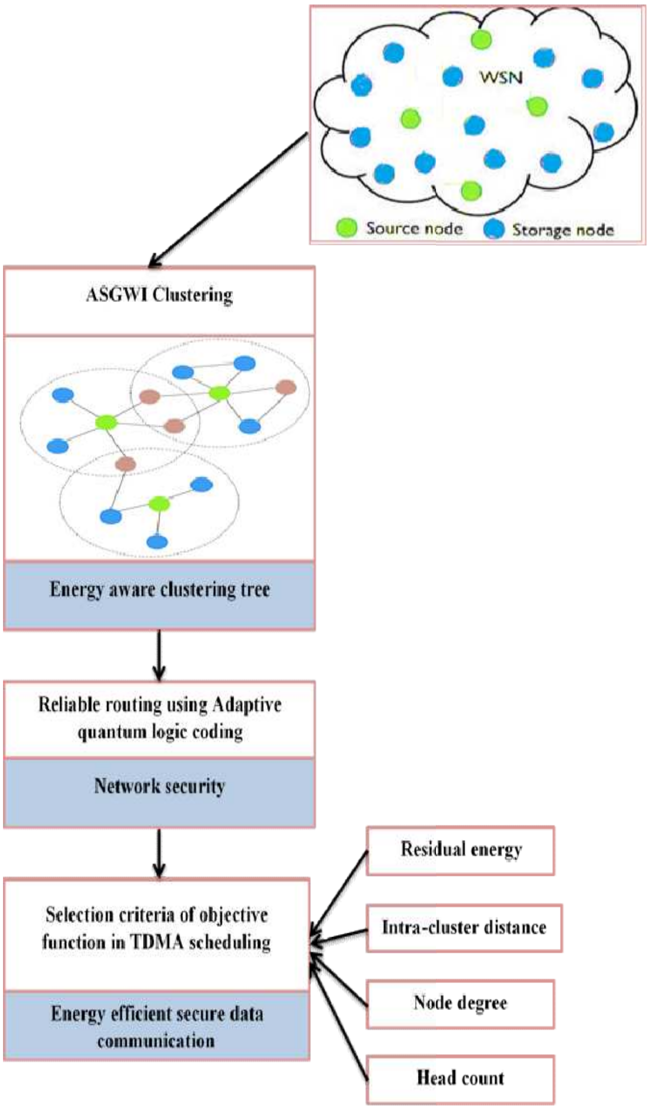


Figure 1: Schematic representation of proposed methodology

3.1 ADAPTABLE STEP SIZE GREY WOLF INSPIRED (ASGWI) CLUSTERING TREE

Grey wolf optimization is a multitude of savvy strategy that copies the association of wolves' control of wolves is surprising for their gathering chasing. In the numerical model for the fittest arrangement is known as the alpha (α). The second and third finest results are termed as beta (β) and delta (δ) independently. Here, the chasing is guided by α, β, and δ. The chasing method and the social progressive system of order of wolves are mathematically displayed so as to broaden the improvement and accomplish advancement.The pseudo code of presented ASFWI is specified in algorithm1,

1: Generate initial search agents
$S_A(A=1,2,3....n)$
2: Initialize the vector's b , P *and* C
3: Compute the fitness approximation of every hunt agent by S_α , S_β , S_δ *step size.*
4: Iteration $I=1$
5: ***repeat***
6: ***for*** $i=1:S_s$ *(search agent pack size)*
restore the location of the current hunt agent
7: ***End for***
8: Measure the fitness value of all hunt agents
9: Update the value of S_α , S_β , S_δ
8: Renew the vectors b , P *and* Q
10: $\hat{I}=\hat{I}+1$
11: until $\hat{I}\geq\hat{I}_{\max}$
12: output S_α
13: Node insertion
14:Link insertion

Algorithm 1: Pseudo code of ASGWI clustering

Step 1: Initialize the optimizationconstraintsfor example, search agents ($\overline{S}_A$), vectors b , P , Q and extreme of iteration ($\hat{I}_{\max}$).

$$\vec{P}=2\vec{b}\cdot r_1-\vec{b} \qquad (1)$$

$$\vec{Q}=2\cdot r_2(2) \qquad (2)$$

The assessments of $\vec{b}$ are straightly lessened from 2 to 0 over the duration of cycles and r_1, r_2 are irregular vectors in [0, 1].

The parameter $\vec{b}$ is directly modernized in all iterations to range from [2-0] according to the condition (3),

$$\vec{b}=2-t''\cdot\frac{2}{\hat{I}_{\max}} \qquad (3)$$

Where, t'' signifies the cycle number and $\hat{I}_{\max}$ is the absolute number of emphasis thought about optimization.

Step 2:Produce wolves subjectively taking into account size of the pack.

Step 3:Estimate the fitness assessment of each chase operator using condition(4)

$$\vec{S}(t''+1)=\vec{S}_p(t'')+\vec{P}\cdot\vec{R} \qquad (4)$$

Where, $\vec{R}$ is as characterized in (5) and t'' signifies the cycle number, $\vec{P}$, $\vec{Q}$ are coefficient vectors, $\vec{S}_p$ signifies the prey point and $\vec{S}$ signifies the gray wolf position.

$$\vec{D} = \left| \vec{C} \cdot \vec{S}_p(t'') - \vec{S}(t) \right| \quad (5)$$

Step 4: Find the best hunt agent (S_α), the subsequent best hunt agent (S_β) and the third best hunt agent (S_δ) by condition (6),

$$\vec{S}_1 = \vec{S}_\alpha - \vec{P}_1.(\vec{R}_\alpha),$$

$$\vec{S}_2 = \vec{S}_\beta - \vec{P}_2.(\vec{R}_\beta) \text{ and } \vec{S}_3 = \vec{S}_\delta - \vec{P}_3.(\vec{R}_\delta) \quad (6)$$

Where, $\vec{R}_\alpha = \left| \vec{Q}_1 \cdot \vec{S}_\alpha - \vec{S} \right|$, $\vec{R}_\beta = \left| \vec{Q}_2 \cdot \vec{S}_\beta - \vec{S} \right|$ and

$$\vec{R}_\delta = \left| \vec{Q}_3 \cdot \vec{S}_\delta - \vec{S} \right| \quad (7)$$

Step 5:Repeat the location of the current chase operator utilizing condition (8)

$$\vec{S}(t''+1) = \frac{(\vec{S}_1 + \vec{S}_2 + \vec{S}_3)}{3} * \sigma(t'') \quad (8)$$

Here, $\sigma(t'')$ signifies a variable Size assessed in condition (9) utilized for the fitness assessment.

Step 6:The step σ is advantageous to adjust the capacity of global exploration and neighbourhood exploitation, and it ought to likewise be concern about its present circumstance. The step σ is determined assubsequent:

$$\sigma(t'') = \frac{0.4}{\left(1 + \exp\left(\frac{0.015 * (t'' - Maxgen)}{3}\right)\right)} \quad (9)$$

In condition (9), t'' denotes the current number of iterations; $Maxgen$ denotes the maximal number of cycles. Different individuals are gotten by utilizing previously mentioned advances and go tosucceedingiteration.

Step 7:Apprise the esteem of $\vec{S}_\alpha$, $\vec{S}_\beta$ and $\vec{S}_\delta$.

Step 8: Check for halting condition i.e., whether or not the emphasis accomplishes generally extraordinary, if indeed, yield the best estimation of arrangement else go to stage 5. The flow representation of ASGWItechnique is displayed in figure 2.

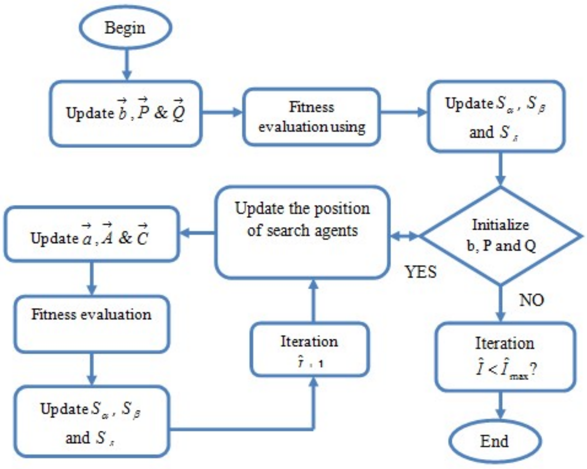


Figure 2: Flow representation of ASGWI algorithm

Here, the ASGWI calculation chooses the successful features for the decrease of features dimensionality. This calculation assesses the wellness of the new arrangement and contrasts it and the current one. At that point, all current arrangements are positioned at every cycle venture as per their wellness and the best arrangement came to so far is put away as the vector (z'_{best}).This technique is applied iteratively until a recommended halting basis is met.

Step 9: Node Insertion

For node insertion z'_{best} esteems are viewed as which the ASGWI aftereffects of every hub in WSN. Each hub is then arranged by the enhancement. At last, the protected hubs are chosen as hand-off hubs for the information transmission.

Step 10: Link Insertion

These chosen hubs are then connected to different hubs which are not a piece of source and objective. The hub which holds the higher enhancement esteem is chosen as dependable hubs for information transmission. By methods for the solid hubs, information is moved from the source to the objective without failures.

3.2 NETWORK SECURITY USING TRANSMIT PACKET CODING

Reliable routing reduces the packet loss, delay, and advances the throughput, however, not giving security to the organization. Here, AQL coding is introduced for network security. It is described in the subsequent subsection.

3.2.1 Adaptive Quantum Logic coding

Quantum coding is a state which isn't equivalent to clearly create of subsystems; this is moreover explained numerically. For instance, there are two transfer hubs T_X, T_Y and the relating composited system T_{XY}. The quantum states of subsystems just as composited framework are $|\psi_X\rangle, |\psi_Y\rangle$ and $|\psi_X\rangle \otimes |\psi_Y\rangle$ individually. In the event that two subsystems ensnared one another, the connection is depicted as seeks after,

$$T_{XY} = T_X \otimes T_Y \quad (10)$$

Nonetheless,

$$\left|\psi_{XY}\right\rangle \neq \left|\psi_{X}\right\rangle \otimes \left|\psi_{Y}\right\rangle \quad (11)$$

There is a combined quantum bit $\left|\psi_{XY}^{+}\right\rangle$, which is quantum snared state, besides, $\left|\psi_{X}\right\rangle$ and $\left|\psi_{Y}\right\rangle$ is ensnared pair. It should satisfy the underneath condition,

$$\left|\psi_{XY}^{+}\right\rangle = \frac{1}{\sqrt{2}}\left\{\left|0_X\right\rangle \otimes \left|1_Y\right\rangle + \left|1_X\right\rangle \otimes \left|0_Y\right\rangle\right\} \quad (12)$$

The feature of this condition is depicted that when the, $\left|\psi_{X}\right\rangle$ is $\left|0\right\rangle$ will be the condition of $\left|\psi_{Y}\right\rangle$ surely is inverse $\left|1\right\rangle$ the other way around. In any case, when $\left|\psi_{X}\right\rangle$ is distorted to Eigen state $\left|1\right\rangle$ by estimation, $\left|\psi_{Y}\right\rangle$ unavoidably falls to inverse opposite Eigen state $\left|0\right\rangle$ the other way around. Moreover, the information packet is coded earlierto safethe broadcast.

3.3 Energy proficient secure data communication byenhanced TDMA Scheduling

The presentedtechnique plans to defeat the issues in existing convention by diminishing the hole of energy among all sensors in each cluster. In this way, when the activity of cluster head determination is made, each cluster head communicates an ad message to pronounce itself as a bunch head (CH) hub. In light of the quality of a publicizing message, every sensor hub gets this message will react to a solicitation to join to that bunch head. In this way, every bunch head knows the quantity of sensor hubs that will join to it. Obviously, there are an alternate number of sensor hubs join to each cluster. In each cycle, another heads are chosen to frame another group. In this way, the organization lifetime can be determined dependent on the quantity of rounds.

3.3.1 Residual Energy

Extra power is necessary for carryingon extended far off neighbors. Throughprocessing that for every node n_i, theenergy measure alongside its neighborsas

$$\hat{E}_R = \sum_{k=1}^{n} \hat{E}(n_j, n_k) \quad (13)$$

The residual energy is used for energy assimilation while picking the cluster head. Condition (13) doesn't show the fluctuation in the midst of good and troublesome hubs. Whatever, a CH ingests less energy when it is incorporated by most loved hubs. In the event that the leftover energy of a hub is lower than that of all the one-bounce neighbors around it, the hub ought to have the most noteworthy priority.

3.3.2 Node degree

The degree of a node is the quantity of edges associated with the hub. As far as the degree for a node indexed in an undirected system is

$$N_{di} = \sum_{j} a_{j,k} \quad (14)$$

Here, the sum is over all hubs in the organization.

3.3.3 Head count

Head count is the quantity cluster head in the cluster. On the off chance that the quantity of cluster heads is less, the information transmission length of sensor hubs to cluster head will be too long which prompts additional energy utilization, and the extreme information got and sent by the bunch head makes it devour inordinate energy. In the event that the quantity of group heads is huge, the complete stack of the organization is clearly expanded, the all-out energy utilization of each round of organizations is expanded, the organization information combination effectiveness is decreased, and the lifetime of the organization isn't drawn out.

3.3.4 Intra cluster distance

The intra class cluster distance is the spaceamongst the data point of one cluster with another data point in other cluster. The complete distance $\overline{D}$ alongside its neighborsas,

$$\overline{D} = \sum_{k=1}^{n} dis(n_j, n_k) \quad (15)$$

It is utilized for energy immersion while selecting the cluster head. Whatever, a headassimilates less energy when it is enveloped via mostdesired nodes. The improvedTDMA plan is introduced in the presented approach in four stages to tackle this issue.

Step 1: Every cluster head calculates the quantity of sensor hubs doled out to its group dependent on these remaining energy, intra cluster distance, and node degree and head count measures.

Step 2: All cluster head communicate a message incorporates the quantity of its own hubs joined to the whole heads in the WSN. At this end, each cluster head knows the limit of the biggest cluster.

Step 3: The limit of the biggest group is chosen to be the actualized length of the TDMA plan for all clusters for consistent state stage.

Step 4: Everyinside each cluster gets an opportunity to send information as per improved TDMA. Notwithstanding, as per the presentedmethodology, each clusterhead sends the enhanced TDMA schedules to their individuals. In this way, every sensor node recognizes its allotted time slot to transmit data. This provides the secure and energy proficient information communication.

4. RESULTS AND DISCUSSION

The implementation of our presented secure and energy effective TDMA dependent mac protocol for WSN utilizing ASGWI clustering and AQL coding is completed in the working platform of MATLAB 2018a. So as to examine the performance of the presented system, diverse of execution estimates such as energy consumption, elapsed time, reliability, solved instances ratio and transmitted packet ratio with the currentDTDMA^{s}, DTDMA^{scd}, TDCS-compact, TDCS-feasible, Two Way Beacon Scheduling (TWBS), and DTDMA^{mcd}.

4.1 ENERGY CONSUMPTION

The server node consolidates predictable energy utilization, which addresses the consistent power usage of all parts special case of the CPU in the degree to the operational time, and dynamic energy use of the executed applications, which relies generally upon the dynamic intensity of the CPU is meant as,

$$\overline{E}_C = C_{energy} + D_{energy} \tag{16}$$

Where, $\overline{E}_C$ signifies the power utilization, D_{energy} signifies the dynamic energy utilization, and C_{energy} signifies the consistent energy utilization.

$$M_{\overline{E}} = \frac{\sum_k^n \overline{E}_{Ck}}{N''} \tag{17}$$

Where, $M_{\overline{E}}$ signifies the mean of energy utilization, and N'' signifies the number of reiterations. The comparison graph of presented with current strategies as far as energy utilization is portrayed in figure 3.

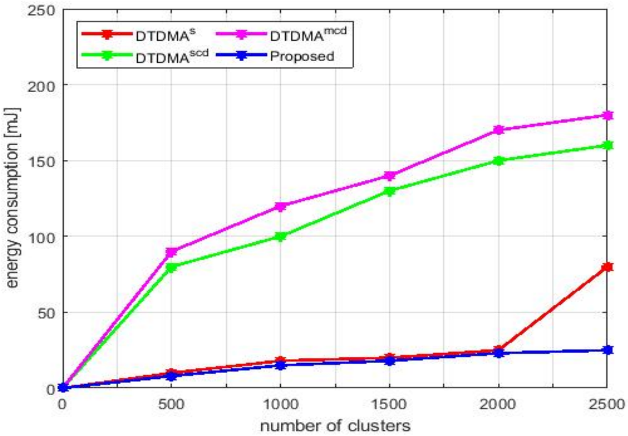


Figure 3: Comparison examination of presented energy consumption

The examination graph in figure 3 depicts that the presentedstrategy gives preferable outcomes over the current methods.

4.2 ELAPSED TIME

It is the amount of time reserved to finish the process. The computational time of scheduling process in seconds isacquired from the information stream size in bit and the bit rate in bit/sec as,

$$E_{time} = {I_{size}}/{B_{rate}} \tag{18}$$

Where, E_{time} denotes the elapsed time, I_{size} denotes the size of the information, B_{rate} denotes the Bit rate.The examination graph of presented with currentstrategies as far as elapsed time is portrayed in figure 4.

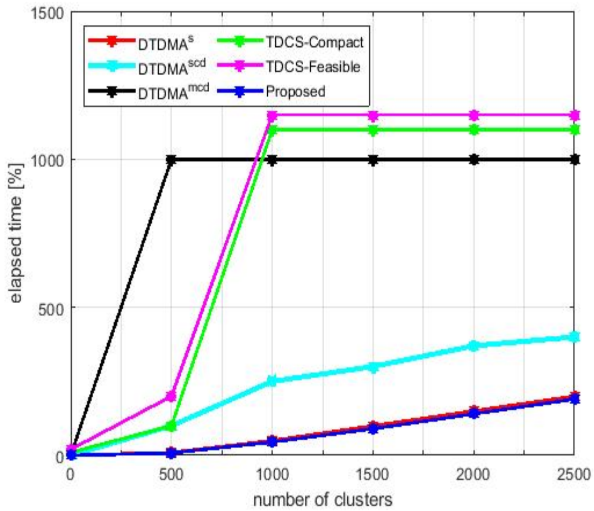


Figure 4: Comparison examination in elapsed time

The comparison graph in figure 4displays that the planned strategy gives preferred outcomes over the current procedures.

4.3 Transmitted packet ratio

It is depicted as the extent of complete packets got to the objective by the all-out number of packets sent from the source. High communicated packet proportion will alter the improved presentation of the convention.

$$P_{ratio} = \left({N_R}/{N_T} \right) * 100 \tag{19}$$

Where, P_{ratio} signifies the Packet delivery ratio, N_R & N_T signifies the total number of packets received and transmitted. The comparison graph with respect totransmitted packet ratio is shown in figure 5,

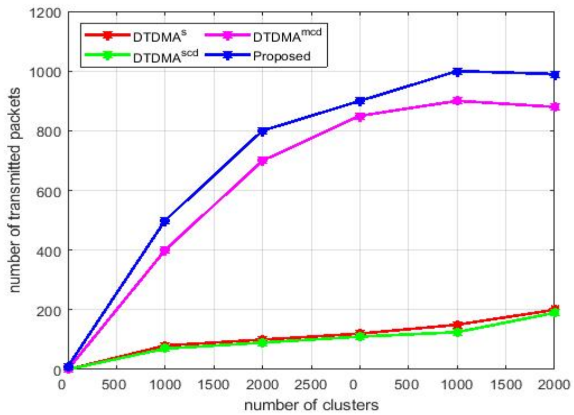


Figure 5: Comparison examination in transmitted packets ratio

The examination chart in figure 5 shows that our presented procedure gives preferred outcomes over the current methods.

4.4 Solved instances ratio

Solved instances are the quantity of information where a system or element communicates or gets information with the one decided time space. It holds the basic parts of measures the bit/second.

$$S_I = \frac{P_d * P_{size}}{S_{time}} \times 100 \tag{20}$$

Where, S_I signifies the solved instances ratio, P_d signifies number of delivered packet, P_{size} signifies size of packet, S_{time} signifies total simulation time.The examination chart of presented with current strategies as far as solved instances proportion is portrayed in figure 6.

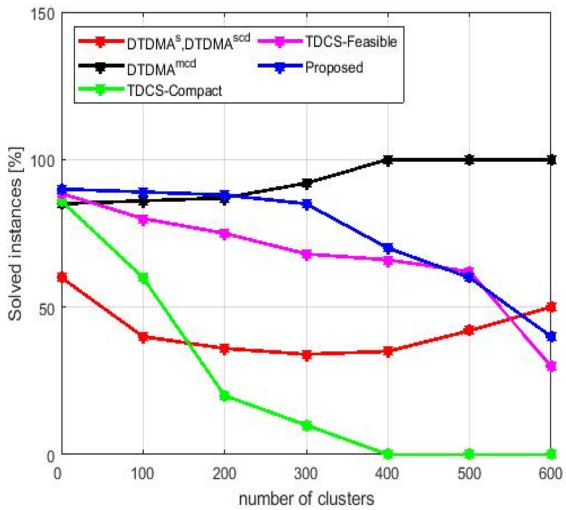
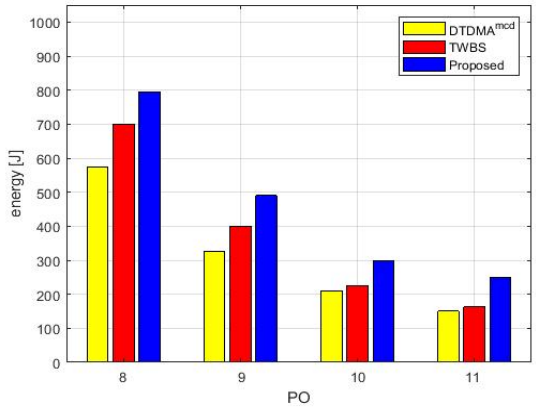


Figure 6: Comparison examinationin solved instances

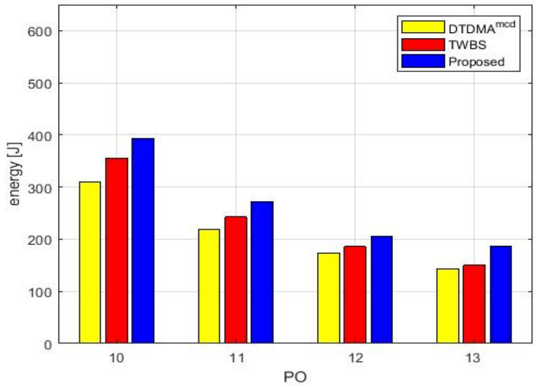
The assessment graph in figure 6displays that our technique providesimprovedoutcomes than the currentmethods.

4.5 Cluster Schedule Energy Consumption

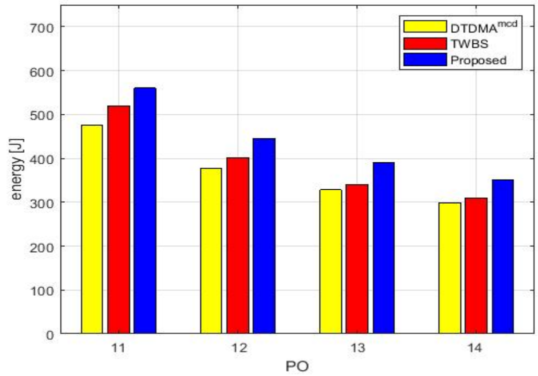
We exhibit the energy utilizationof clusters, as a roleto the estimation of*PO*, when the cluster schedule is consecutively for termof 60 min. The longer schedule periodlowers the energy consumption. The assessment graph of presented with existing strategies regarding cluster schedule energy utilization is portrayed in figure 7.



7(a)



7(b)



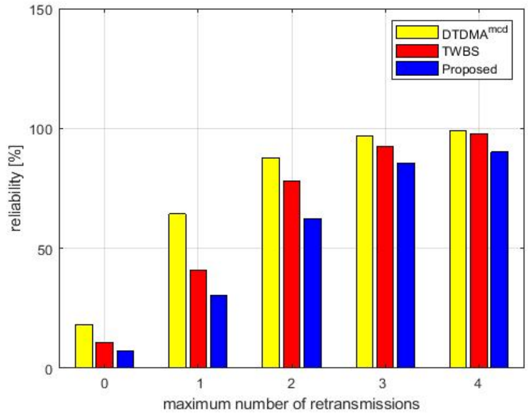
7(c)

Figure 7: The energy consumption of network within 60 min dependent on the cluster scheduling as a function to the esteem of *PO* and the number of clusters.

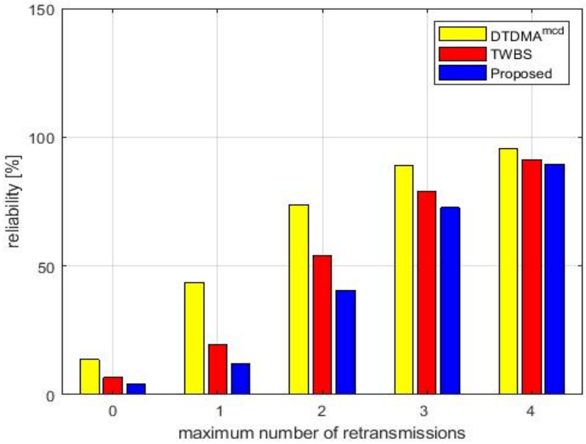
In figure 7, the outcomes demonstrate the energy effectiveness of our proposed disseminated calculations. Despite the fact that the quantity of communicated packets may be high, in any case, the parcels are of a little size and, thusly, the energy utilization is low.

4.6 Network Reliability

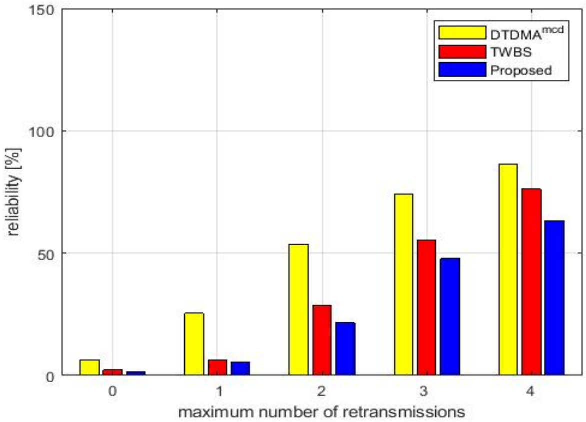
The reliability of the system isdetermined as the level of the effective transmissions for every information flow from the source hub to the sink hub. The examination chart of presented with current techniques regarding network reliability is portrayed in figure 8.



8(a)



8(b)



8(c)

Figure 8: The effect of the loss rate on the network reliability

In figure 8, we delineate the dependability of the organization dependent on the schedule acquired through the proposed, $DTDMA^{mcd}$ and TWBS. The outcomes show that the higher the quantity of re-transmissions and the lower the loss rate, the more the packets that are dispatched by the source hubs arrive at the sink hubs. Subsequently, the reliability of the system is expanded.

5. CONCLUSION

This paper introduced a Secure and Energy Efficient TDMA based MAC Protocol in WSNs.The ASGWI clustering methodology is presented for creating powerful cluster trees by ideal choice of cluster heads. Afterwards, reliable routing is provided by the AQL coding to advance the system security in WSN. At last, the energy effective secure information correspondence approach is proposed inside the cluster for TDMA scheduling. Here, the effective estimates are utilized to improve the TDMA planning. The presented TDMA scheduling for Cluster-tree topology in WSNs meets the practicality and the energy demands. The simulated outcomes are demonstrating that the presented protocol works better than the existing $DTDMA^{s}$, $DTDMA^{scd}$, TDCS-compact, TDCS-feasible, TWBS and $DTDMA^{mcd}$techniques as far as network throughput, end-to-end delay, packet delivery ratio and the remaining energy level of the nodes. It results the higher packet reception rate, diminished elapsed time, superior reliability and furthermore lesser energy consumption.

DECLARATION STATEMENTS

I. Funding Details:
There are no funding details available.

II. Conflict of Interest:
The authors declare that they have no known competing for financial interests or personal relationships that could have influenced the work reported in this paper.

- ✓ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:
- ✓ The Research work has been carried out utilizing R& D Lab setup with the Department of Computer Science and Engineering, Osmania University, Hyderabad, Telangana, India.

III. Informed Consent
There is no Informed Consent.

IV. Author's Contribution
1.Author Name: Ramdas Vankdothu,
- ✓ Conceived and Designed the Analysis
- ✓ Collected of the Data
- ✓ Contributed Data or Analysis Tools
- ✓ Performed the Analysis
- ✓ Analysis of Result

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