International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-4, February 2020

Energy Efficient Scheduling Scheme for Wireless Sensor Network

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Abstract: ***Energy conservation in wireless sensor network (WSN) is a critical need for efficient application in real time interface. Due to a continuous active mode operation, the nodes terminals have a large energy dissipation, which leads to faster energy dissipation. The need of energy conservation in wireless sensor terminals is very critical due to its remote battery energy source. In order to conserve energy, Terminals in WSN are scheduled to operate in different operative modes resulting in active and no-active modes called sleep operation. The scheduling resulted in higher energy conservation, however the static period scheduling of phase switching in WSN operation leads to additional switching energy loss. In this paper, a new scheduling Method for energy conservation using a active learning Exchange called 'Tick' wake attribute is used for adaptive control of operational switching in WSN. The proposed Method is a monitoring Method for energy conservation in WSN by operating in cluster mode operation. The operational condition in a simulation of distributed WSN nodes illustrated a higher energy conservation, and resulting in improvement of node life time and network metric in WSN interface.***

Keywords: ***Wireless sensor network, adaptive operative scheduling, tick wake Exchanging, energy conservation***

I. INTRODUCTION

With various advantages of having low cost deployment, less maintenance, higher reliability etc., these networks are field installed. The Terminals in WSN are distantly located, where energy resource are essentially the battery component. As every Terminal in this arrangement get contribution in information switch using, energy for every Terminal, incessantly exhaust away with every up-link and down-link of information data. The Terminals are arbitrarily organize in the distance, the unit, the correspond procedure etc., which identify the speed of energy exhaust in these arrangement. Terminals communicating by means of lesser energy level or large data exchange leads to jamming which exhaust at an earlier speed in contrast to supplementary Terminals. WSN is a co-operative base exchange, where every Terminal has a better significance in exchanging or computing of information data.

Revised Manuscript Received on February 28, 2020.
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In these situations it is first and foremost necessary to include appropriate method to preserve energy to small power at the Terminal, so as to keep hold of the network for more active time. A variety of technique were presented in current times by means of new Method of management of power in wireless sensor network, a cluster mode Method by means of active representation [1,2], forecast method [3], and interfering oriented computation [4] were recommended in earlier period. Towards preservation of power in Wireless sensor network, a power yield method using arrangement repositioning and Terminal allotment in network control is recommended. The recommended method defines a novel Layout of rearrangement logic for power management. In the operational stage, a novel scheduling method of Terminal process using Terminal Scheduling process is recommended in [3]. The Terminals are operated in sleep, awaken, communicate and inactive phase. In the energy management, the Terminals are processed for power preservation using access organize by means of MAC protocol where a power preservation use on interference in the interlinks are measured [5] to attain power preservation. A power yielding method for power preservation is recommended in [8], where the Terminal sensor generates an power production by employing the Terminal process phase. Use on the means of admission operation power preservation and yielding is presented in [7]. In [15] a energy conservation use on the scheduling of Terminal operation and the access of radio frequency used in the MAC accessing is proposed. To conserve energy, the scheduling of operation is defined for operation and harvesting mode. Wherein mechanisms were proposed in the energy conservation used for Terminal energy level enhancement, Terminal interference were less concentrated. Scheduling Method [3],[4],[6] were suggested in energy conservation, however, the access monitoring or energy conservation in terms of operational scheduling is not suggested. The usual power scheduling method is seen to have a limitation of uninterrupted monitoring power limitation, or Data loosening problems and Exchanging burden owing to sleep scheduling. To resolve these problems, in this paper, a novel scheduling method use on a monitoring updation of demand Data is projected called as a 'Tick Exchanging'. To outline the projected method, this paper is summarized in 7 sections. Where section 2 presented the usual Methods of power scheduling and preservation method for wireless sensor network. The method of Terminal modeling for wireless sensor network with a data transfer monitored governing is summarize in section 3. Section 4 summarizes the projected power preservation protocol for data exchange. Section 5 sketch out the simulation outcome for the presented Method and the conclusion of the presented proposal is made in section 6.

II. POWER OPTIMIZED EXCHANGE IN WSN

Wireless sensor network has been monitored as a new mode of data exchange in data monitoring in acquisition. In the data exchange process, the Data are exchanged in the network model using the exchange use on the Data exchange mode.

When compared to other types of wireless data exchange mechanism such as Adhoc network, mesh network, etc., the wireless sensor has its own limitations. Wherein other Terminals are used for data exchange, wireless sensor networks are been used for communicating sensed data using a network using integrated sensor Terminals and the wireless exchange protocol.

The sensor Terminals measured the physical parameters such as the temperature, pressure, humidity, etc., in monitoring of physical parameters in a wide distributed network in various industries application. The advantages of this network is the self deployment property and the capability of self creation of data exchange routes for switching Data using intermediate Terminals. The self creation property make this network ease in deployment in different network zone resulting in faster and optimal monitoring of physical parameter in a wide distributed environment.

In wireless sensor network, the exchange of data is most critical requirement for its usage. As the data measured are critical for its monitoring and monitoring, the measured are to be transmitted using the network at the fastest rate, with highest level of accuracy. Towards the objective of achieving these requirements, in [1] a cluster use exchange, was suggested. Cluster use exchange, has emerged as an optimal solution to long range exchange using multi hop exchange, with resources dynamically placed. The offered bandwidth and the power of transmission per Terminal are the prime observatory in such requirement. As each Terminal is operated as a intermediate router to exchange data, continuous exhaust of power is monitored to be a critical parameter to optimize. Towards achieving power optimization, a distributed cluster Monitoring scheduling (DCHS) mechanism to achieve maximization in network life time in WSN was presented in [1].

The Method divide the network into two tier level, of primary and secondary level use on the residual power and Exchange strength indication of sensor Terminals. The Method here defines a two level cluster Monitoring Method to optimize the power level. A selection of gateway and cluster Monitoring among two tier network level indicates the advantage of longer Monitoring period and less updation process of Monitoring selection and gateway selection. With a similar objective in [2] an analysis on investigation of direct minimum transmission energy (MTE), low energy cluster Monitoring (LEACH) and zone clustering Method for power conservation on wireless network was performed out. An energy efficient zone clustering called EZone was proposed use on single and multiple gateway scenario. The Method of zone use coding was monitored to be significant in service area coverage as compared to other routing Methods. An extensive simulation was made on Matlab tool to observe the performance of the suggested Method on wireless network. In [3] a unequal clustering Method use on energy aware coding was proposed. The suggested energy aware distributed unequal clustering protocol (EADUC), was defined to solve the problem of energy hole problem in WSN. The Method defines the cluster formation use on the location of the Terminals and residual energy available. The Monitoring selection is use on the coverage range of the Terminal and the data exchanges are performed via a mini and major time slot. In [4], for clustering a energy and proximity use Method was suggested. The problem of range limitation on forwarding of data is suggested. A inter cluster Monitoring proximity while factoring the relaying activity is suggested for load balancing on cluster Monitoring.

Power is the main limitation in a self placed network, where each Terminal has a limited power source to exchange data. The Terminals in the network are scheduled for an ON and OFF condition use on the interface in the network, and the Terminals are turned to idle state when the Terminals are not in exchange.

However this process, is not optimal in WSN application, as the Terminal in WSN are to be enable to either storage and transmit their own data or need to be in the network for exchange of data for the interlinked Terminals. In both the case, the Terminals need to be active to exchange Data. Hence, in such network, the conservation of energy in a scheduling mode is a difficult task. In such case it is needed to develop a proper scheduling and routing mechanism to cooperative exchange in wireless sensor network. The mechanism of a Layout gusingnance mechanism in WSN need to decide,

1. The switching OT of a Terminal
2. The period of their monitoring
3. The transmitting energy needed.

In a Layout governance mechanism the Terminals are defined into zones, where each zone is called a cluster. The Terminals are defined as a regional Monitoring having highest energy level. the Terminals are interlinked to form a network which is defined for either a Monitoring to Monitoring exchange, or a with intermediate Terminal called gateway. The data are exchanged using the network from a Terminal to the Monitoring intern exchanged through gateway to the receiver Terminal. The power reduction is performed away by means of a variety of dissimilar Layout organization Methods, in which use on the sharing of the Terminals in the network power scheduling is performed. With such Method of Layout organization and scheduling Methods, a skip use displace scheduling Method (HDS) [9] is presented. This technique is an incorporated form of power scheduling with network Layout, where the monitoring and scheduling is performed out in three prerequisite and declaration phases.

III. NETWORK OUTLINE FOR WIRELESS SENSOR NETWORK

The projected Method is proposed with the goal of monitoring the data stream in the Terminal stage to keep away from several jamming formed through information transmitting using the Terminal. The jamming direct to network jam is far above the ground power exhaust due to Exchanging demand and information storing. The Terminals are therefore programmed for power preservation by other Methods as presented in portion 2 above. Every Terminal is placed at a network stage as demonstrate in figure 1.

Terminals are classified as "Monitoring, gateway and member" Terminals as mentioned in [1] to form a power preserving network form.

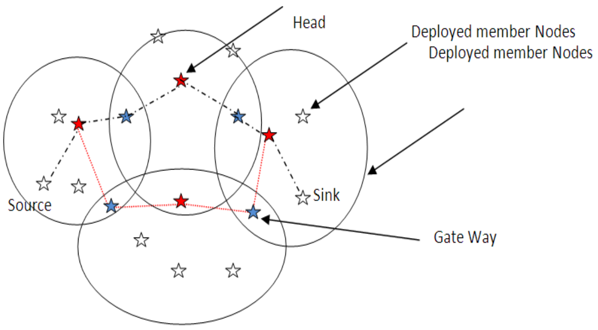


Figure 1: Placed wireless sensor network for energy conservation

At this point the Terminals are programmed for Terminal assortment, and exchange as presented in [1]. The essential restriction monitored in this exchange Method is the permanent active process of Monitoring Terminal, computing cost at gateways and lesser power value at affiliated Terminals.

The Method of Monitoring discovery and gateway selection is as presented below,

Two possible links to forward data,

Connection fulfilling the principle as declared underneath resolve the chosen for forwarding.

Mechanism monitoring discovery:

For every group G_i,
For k Terminals,
Do,
If power ($P_T(i)$) >= $P_T(i-1)$)
present Monitoring Terminal (H_m) =T(i)
Else
present Monitoring Terminal (H_m) = T(i-1);
End
End
For every present Monitoring Terminals (H_m) chosen,
Do,
Ts = To. of one hop Terminals updated,
If Ts(H_m (i)) >= Ts(H_m (i+1))
Group Monitoring Terminal (G H_m) = Ts(i);
Else
Group Monitoring Terminal (G H_m) = Ts(i+1);
End

Mechanism Gateway Selection:

For every Terminal T in network,

If power_max(T(i) ϵ ($G_i \cap G_{i+1}$))

T(i) = G_{wi};

end

The power restriction at associate point and permanent power exhaust at "Monitoring and gateway" stage outcome in quicker power exhaust and Terminal breaking up. To resolve this problem a novel exchange protocol for power scheduling is projected, presented in subsequent portion.

IV. PROPOSED EXCHANGE PROTOCOL

In the proposed Method, a randomized wake period by the extension of sleep phase is proposed, to conserve power utilization in sensor Terminal operation. In consideration to 802.11 CSMA/CA model of a WSN Terminal the power conservation is presented in 4 mode of operations, namely, the sleep, wake up, ideal and Monitor period. In the exchange process, the Terminals enter to a Monitor mode and check for its request, if a pending request is found, exchange is performed out. Upon the completion or on no request availability, the Terminal enters into the sleep mode again. In the data exchange, wakeup cycles of (T_1 ,T_2) duration is defined in the Terminals. The Terminals enter into the wake up phase for each of this wake period to check for a request. However, the state transition burden from one mode to other is considerable when the switching is high. Hence, the operating mode switching is to be governed to minimize the switching counts or switching burden to conserve power utilization. The operation mechanism of the proposed Method is summarized as,

Mechanism

For a wake period (T_i)
Do,
Monitor the request from the registered Monitoring,
If request is pending,
Enter to wake up mode at t_m,
Retain in Monitor mode for t_m,t_{m+k} period,
Receive Data,
Compute power of Exhaust (P_{Diss}) as,
$P_{Diss} = P_{tr}+P_{rx}$
Where, P_{tr},$P_{rx}$are the transmitting and receiving power.
If time<t_{m+k}
If pending_req = 1
Extend wake period (t_m) by t_e, where t_e is the extension period,
Else
Enter to sleep mode.
end

In the exchange, at initial phase, all Terminals broadcast a status Data and exchange the details among different one hop side with their current power level and a help selection is made use on maximum energy level. During the exchange period, each of the Terminal dissipate (P_{Diss}) power level, and minimizes the power level. In the exchange period, each of the Terminal forward their respective data to their registered Monitoring Terminal and enter to sleep mode. The Monitor period of each Terminal is set to wake the Terminal and check for its available pending request. The Monitoring Terminal is declared as an "Active_Master" Terminal. The Monitor up time t_{im} is also known to the "Active_Master" Terminal and to the one hop sides of each Terminal. As every Terminal be acquainted with it's one skip side id and its Monitor counter w_i as of transmit Data.

Every Terminal in the network have alike “pseudo-random” numeral creator. So while a “Active_Master” or side of Terminal desires to forward Data to T_i, it will forward at instance t_m. following the Terminal T_i accept Data, it moves to ‘OFF’ once again. consequently, for a “Active_Master” and sides Terminals, the Data contain to be storage at MAC layer till instance t_m. Following a minimal instance t_k, if no Data are forward to it, it moves to ‘Sleep’ for a second time. If the Terminal T_i needs to forward Data to the “Active_Master”, it senses the feed starting to the ending of transmit period or while reaching to destination at MAC layer for broadcasting, awaiting the medium moves to ‘idle’. The Terminal T_i employ “standard 802.11 back-off” mechanism, if Request for medium happen. while the medium is ‘idle’, it will forward Datas to the “Active_Master”. Terminal Ti awaken subsequent to broadcast is ended and take note again at moment ti or T, either comes former. If the Terminal k desires to forward Data to its side Ti additional to its “Active_Master”, Terminal k take note at moment t_i as Terminal T_i Monitors at instance t_i, and forward Datas to Terminal T_i, if the medium is ‘idle’. following every awaken sequence (T_m, T_{m+1}) in connection phase Monitor counter w_i is increased. If w_i is unaffected, the Terminal k by means of Monitor up moment t_{km}, slight former than Monitor up moment t_m of Terminal Ti obtain additional output than Terminal Ti, as Data transmitted to Terminal k for all time lie on top to the Monitor up phase (t_{im}, t_{im} +T) of Terminal T_i. Thus Terminal k obtain additional output than Terminal T_i. while the Monitor counter w_i is added subsequent to each awaken phase (T_m,T_{m+1}) in connection phase T, Monitor up instance of every Terminal is reallocate in the instance stage (T_m,T_{m+1}) and every Active Terminals obtain reasonable allocation of output.

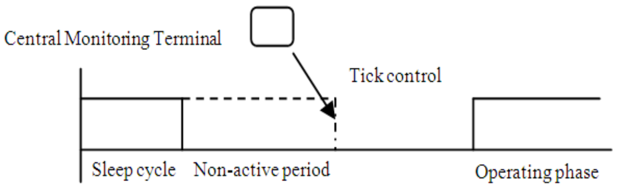
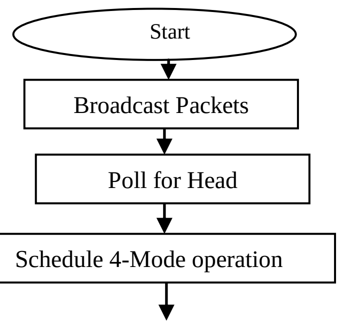


Figure 2: Presented power scheduling Method

To conserve the power exhaust, the Terminal with a scheduled sleep cycle extended for an addition time period (t_k) when no trigger Exchange is monitored. In this proposed conservation Method, the wake state entry is controlled via a control Exchange generated from the registered “Active_Master” Terminal. The Terminal is given the operation of evaluating the Terminal ID and generate a tick Exchange as a wake hit to the pending request in the network. The operation of schedule extension is illustrated in figure 2. The operation flow chart of the proposed Method is as shown below.



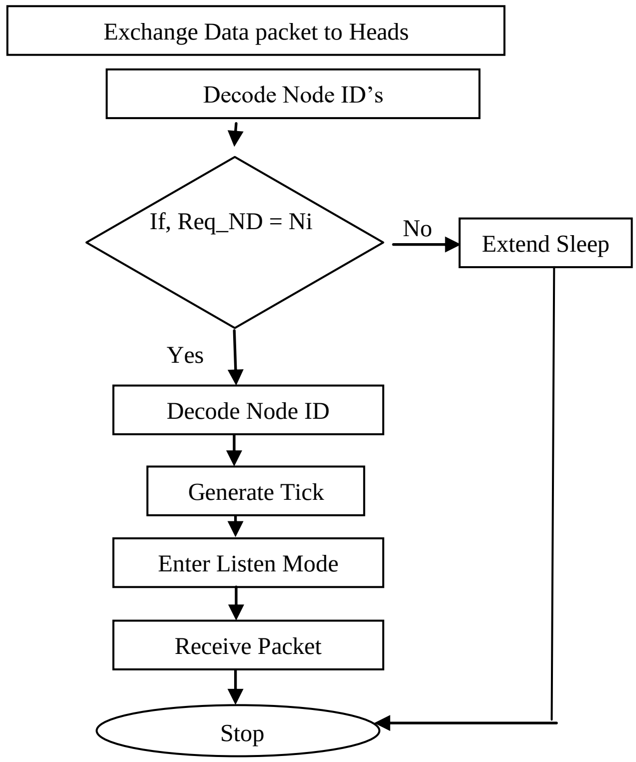


Figure 3: Operational Flow chart of the proposed approach

V. RESULTS AND DISCUSSION

The evaluation of the proposed approach is tested for a randomly distribute network layout with a NxN network layout, where 4 modes of power dissipation is considered in reference to the IEEE 802.11 NIC standard of interfacing at 2Mbps operating speed.
The power dissipation for the 4 operational stages is presented in table 1 below.

Table 1: Power dissipation value in reference to IEEE 802.11NIC interface

Tx	Rx	Idle	Wakeuping
1400mW	1000mW	830mW	130mW

The network is simulated for a given parameter as listed in table 2.

Table 2: Parameters used of the Network modeling

Details	Values
Number of Nodes	30,45
Area of netork	300 x 300
Range	45 Units
Mobility of Node	Non-static movement
Architecture	Random topology
MAC	802.11
Power considered	IEEE 802.11

The simulation result obtained are as illustrated below,

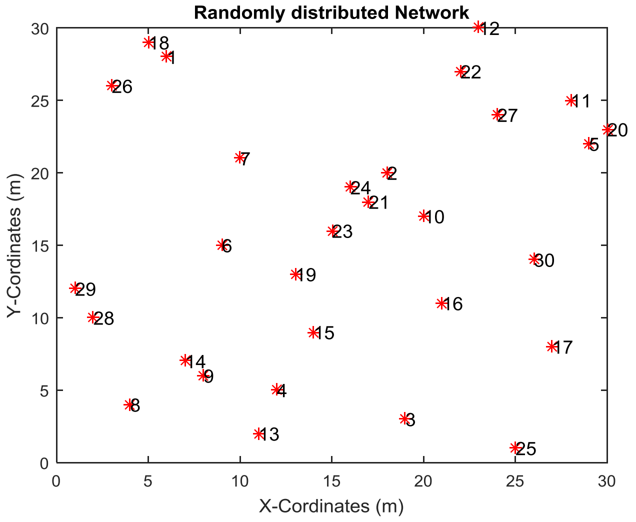


Figure 4: A random node terminals deployment for simulation network

The network is deployed with a randomly distributed node alignment with nodes been scattered over a given network area. The network is defined for a network parameter represented in meters (m). The nodes are placed in x, coordinates in synonymous to the geographical positioning of nodes in the simulation area illustrated in figure 4 above.

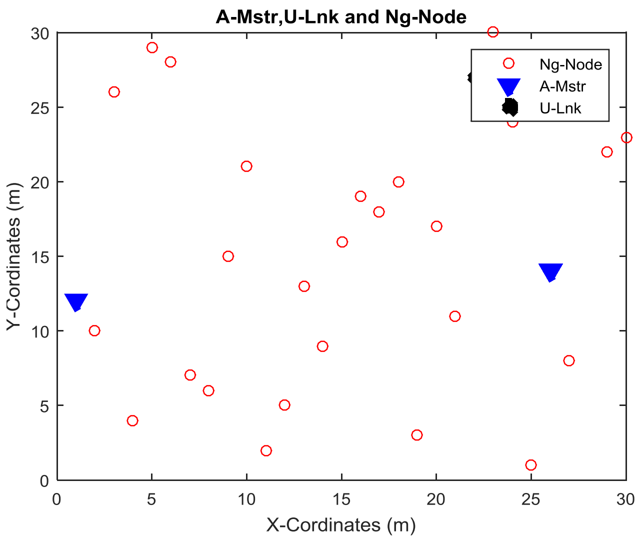


Figure 5: Selected Monitoring nodes and exchange terminals

The network is processed for a group creation, where nodes are communicated with requesting broadcasting packet over the network following range constraint. All the nodes in the communication range are linked to form a side node list which is then segregated to for a group cluster. Among the formed clusters nodes with highest energy is pooled for a centralized monitoring node. Nodes with a common overlapping zone among two clusters in selected as gateways. In case of more than one node in the intersection zone is observed, a node with higher energy is selected as gateway node. The deployments of the selected nodes are illustrated in figure 5.

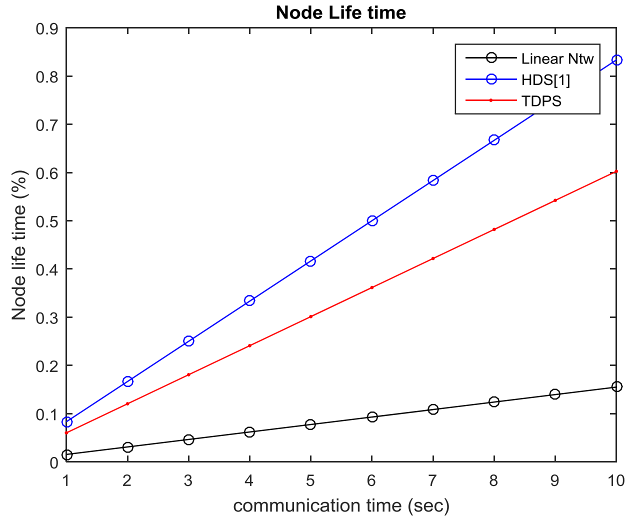


Figure 6: Life time observation of nodes in the network

An observation of the node life time measures as the aggregated power level in the nodes is monitored. The increase in the node life time reflect a higher level of node sustaining and hence improves the possibility of data exchange. The power conservation approach is performed by a power scheduling of node operation cycle to reduce the power dissipation. This optimization resulted in node suiting with power for longer time even for a lower power level unit in the network. The aggregated node power in the network and the paths selected results in longer sustainability of the network.

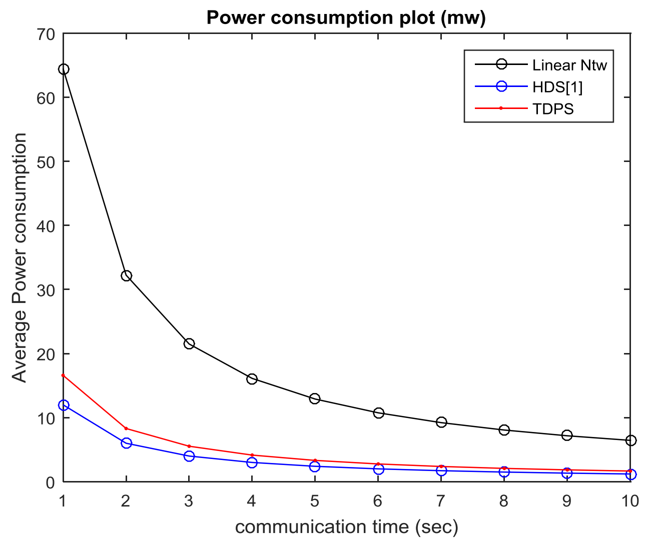


Figure 7: Power usage of the nodes

The average power consumption for the developed network is illustrated in figure 7 above. This approach is analyzed for lower power dissipation using energy conservation approach developed over a communication period. In the proposed approach the extension of a non active period and control of power dissipation results in lower power consumption as most of the time the node remains in sleep phase. The observation for power conservation using the proposed approach over the conventional approach is as illustrated in figure 7.

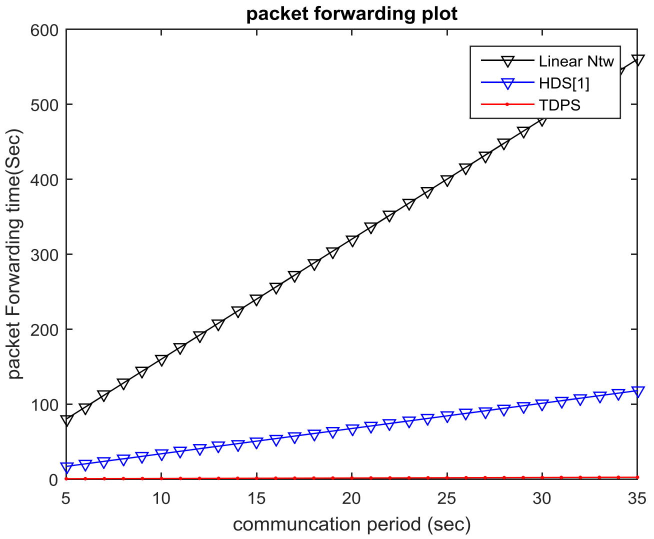


Figure 8: time for packet forwarding

As the network is processed for energy conservation, and the control signal monitored by the monitoring node results in accurate wake up of the nodes when a packet is exchange. An instant requesting minimized the packet buffering delay and hence results in faster data exchange. The node hence gets free faster resulting in higher packet forwarding. The time of packet forwarding is resulted because of the delay encountered in paths during packet exchange. This is observed to lower for the proposed approach as compared to the conventional methods of data exchange.

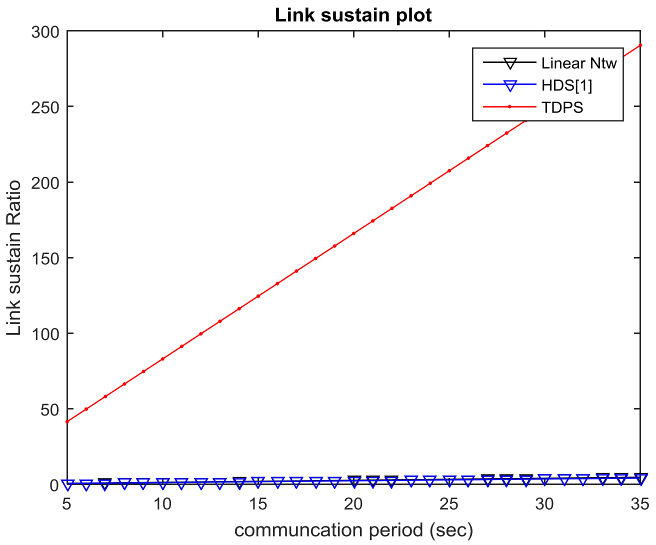


Figure 9: path sustaining over communication time plot

The link sustain period is observed to be improved by the proposed approach of monitored scheduling scheme. In the approach ach of the node keeps in inactive stage for a period of non communicating period. In this case, the nodes conserved the power and hence improve the sustaining time period. The link observed in this case sustain for a longer period as the power sustaining probability increase. The sustain of link time results in higher life time for network interface in the network.

The analysis node density variation over the proposed approach is performed by changing a node density of value 45. The analysis is performed for the metrics computed in above observations, and illustrated in figure 10-15 below.

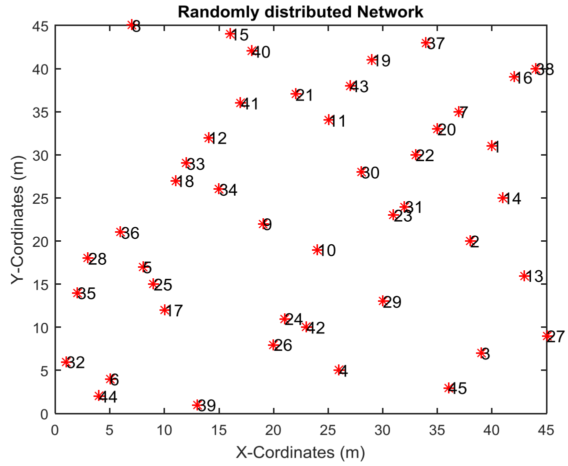


Figure 10: Node distribution for a node density of 45

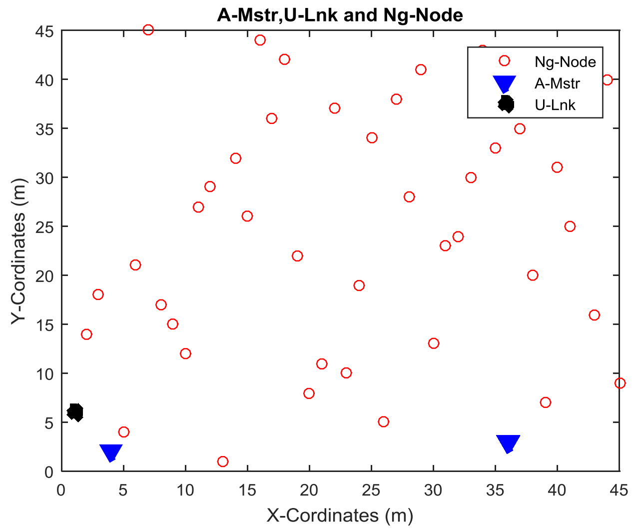


Figure 11: Node selection and deployment of monitoring and gateway nodes in the network

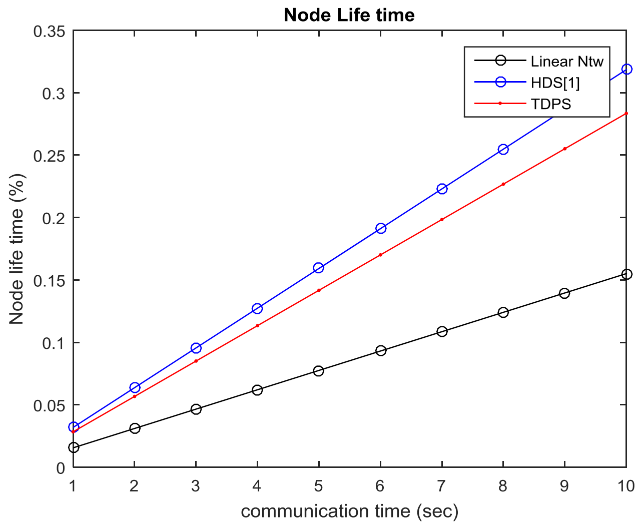


Figure 12: Life item plot for the proposed approaches

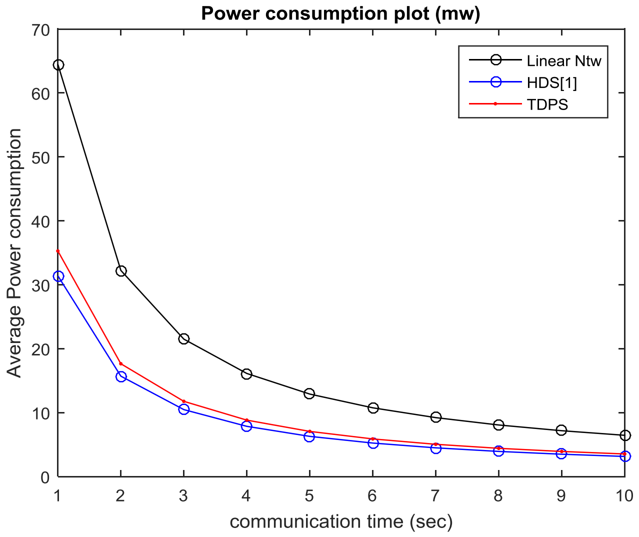


Figure 13: consumed power per node with communication time variation

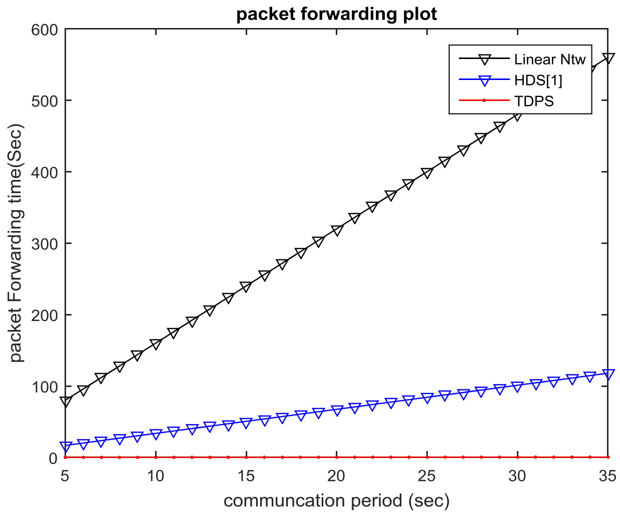


Figure 14: Time of packet forwarding over the communication period

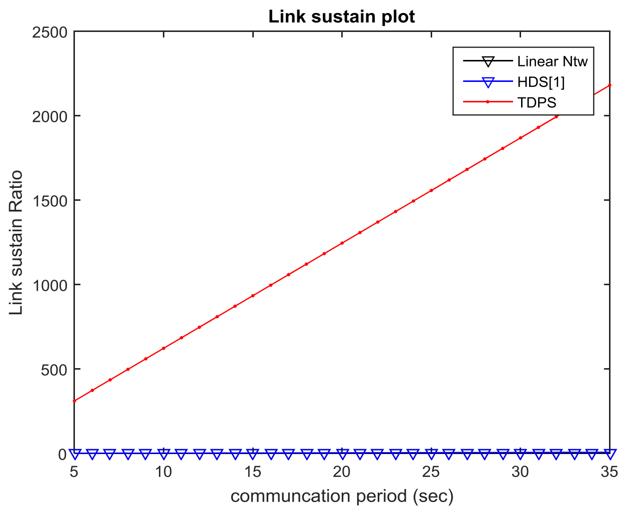


Figure 15: Link sustaining ratio of developed approaches

The variation in node density also result a similar observation as observed with lower density. This illustrates that the variation of node density the controlling feature of the proposed approach is remained intact and large power diction is controlled by the node variation. This resulted in for a optimal power, link sustaining and network life time improvement.

VI. CONCLUSION

The approach of power conservation using a scheduling of sleep period in a dynamic mode for WSN nodes is presented. The energy conservation in WSN node terminal using a scheduling approach is proposed. In comparison to the existing power monitoring scheme where control of operation is performed using stand alone node monitoring, in this work a distribution of nodes in the network with their positioning is considered. The approach performs a new controlling of node operation based on the monitoring of exchange request into the network using node characteristic. The mode of computation resulted in longer network life time and link sustaining period. The power consumption per node is observed to be minimized and the aggregated power level is controlled by using a adaptive monitoring of listening period in the network.

REFERENCES

1. A. B. M. Alim Al Islam, ChowdhurySayeedHyder, HumayunKabir, MahmudaNaznin, “Stable Sensor Network (SSN): A Dynamic Clustering Technique for Maximizing Stability in Wireless Sensor Networks”, scientific research wireless sensor network, 2010.
2. Sandra Sendra, Jaime Lloret, Miguel García and José F. Toledo, “Energy saving and energy optimization techniques for Wireless Sensor Networks”, Journal of Communications, Sep 2011.
3. SubhashDharDwivedi, Praveen Kaushik, “Energy Efficient Routing Algorithm with sleep scheduling in Wireless Sensor Network”, International Journal of Computer Science and Information Technologies, 2012.
4. Zilong Liao, Deshi Li, and Jian Chen, “A Handshake Based Ordered Scheduling MAC Protocol for Underwater Acoustic Local Area Networks”, HINDAWI International Journal of Distributed Sensor Networks, 2015.
5. S. M. Kamruzzaman, “An Energy Efficient Multichannel MAC Protocol for Cognitive Radio Ad Hoc Networks”, International Journal of Communication Networks and Information Security, Aug 2010.
6. Guodong Sun, GuofuQiao and Lin Zhao, “Efficient link scheduling for rechargeable wireless ad hoc and sensor networks”, EURASIP Journal on Wireless Communications and Networking 2013.
7. XenofonFafoutis, XenofonFafoutis, “ODMAC: An On-Demand MAC Protocol for Energy Harvesting - Wireless Sensor Networks”, PE-WASUN’11, November, 2011.
8. ZhiAngEu, Hwee-Pink Tan, Winston K.G. Seah, “Design and performance analysis of MAC schemes for Wireless Sensor Networks Energyed by Ambient Energy Harvesting”, ELSEVIER, 6 Aug 2010.
9. EunHwa Kim, “A Density Control Scheme Based on Disjoint Wakeup Scheduling in Wireless Sensor Networks”, International Journal of Smart Home Vol.7, No.5,2013.
10. B. Chen, K. Jamieson, H. Balakrishnan, and R. Morris, “SPAN: An Energy-Efficient Coordination Algorithm for Topology Maintenance in Ad Hoc Wireless Networks”, International Conference on Mobile Computing and Networking, July, 2008.
11. Shankaraiah and PallapaVenkataram, “A Dynamic Topology Management in a Hybrid Wireless Superstore Network”, International Journal on Computer Network and Information Security, 2011.
12. Li (Erran) Li, Joseph Y. Halpern, ParamvirBahl, Yi-Min Wang, and Roger Wattenhofer, “A Cone-Based Distributed Topology-Control Algorithm for Wireless Multi-Hop Networks”, IEEE/ACM Transactions on Networking, Vol. 13, no. 1, February 2005.
13. Douglas M. Blough, “The K-Neigh Protocol for Symmetric Topology Control in Ad Hoc Networks”, MobiHoc, ACM 2003.

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