EVALUATING THE PERFORMANCE OF FIVE LEVEL THRESHOLD BASED STABLE ELECTION PROTOCOL

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ABSTRACT

This paper has focused to raising the network lifetime of three stage based TSEP heterogeneous protocol of WSNs using the five stage heterogeneity level and also by using the hard and soft thresholding. The residual of the energies of the sensor nodes have used to get the optimum cluster heads. It doesn't necessitate any world wide data of energy at any time through the duration of WSNs. The proposed five level reactive Stable election protocol has been designed and implemented in the MATLAB using data analysis toolbox. The comparison among TSEP and proposed protocol has also been done based upon packets communicated, energy consumption and network life time. The comparisons has shown that the proposed technique outperforms over the TSEP. Also due to five level heterogeneity the proposed protocol seems to be more realistic than the available one.

KEYWORDS:- WSN, TSEP, Ultra-super energy.

1. INTRODUCTION

Wireless Sensor network is composed of many small distributed sensor nodes that provide the reliable monitoring in various environments such as military battlefield surveillance, drug identification, recognition security and civil application and automatic security. In WSN every sensor node contains specific hardware, memory & processing unit. Tiny sensor nodes process the data and send it to base station called as sink. For communication of data between nodes and sink many routing technologies are used, such as multihop data transmission and direct communication. The main constraint in WSN is limited battery power which plays a great influence on the lifetime and the quality of the network. Several routing protocols have been intended to satisfy energy consumption and efficiency requirement of WSN. By using hierarchical routing efficiency, lifetime and scalability of wireless sensor network can be improved. Here, sensors are organized themselves into clusters and each cluster represented by its cluster head [1].The main role of cluster head is to provide data communication between sensor nodes and the base station efficiently [2]. Lifetime of WSN can be enhanced with help of heterogeneity of nodes in WSN Heterogeneous WSN consists sensor nodes with different ability like different sensing range and computing power. Clustering techniques can be of two types: homogeneous clustering scheme i.e. applied in homogeneous sensor networks and heterogeneous clustering schemes. i.e. is applied in the heterogeneous sensor networks .LEACH consists same energy level nodes . The energy saving schemes for homogeneous wireless sensor networks not well performed on heterogeneous wireless sensor network. Thus, for the characteristic of heterogeneous wireless sensor networks energy efficient clustering protocols should be designed.

2. LITERAUTRE SURVEY

A. Ahlawat et al. [1] has proposed a new technique in which concept of Vice Cluster head has been taken out. Vice Cluster head has been selected as alternate head that has worked when the cluster head has fallen down. Criteria for the selection of vice cluster head have set up on the basis of three factors i.e. Minimum distance, maximum residual energy, and minimum energy. Improvement in the network life has been obtained because of the cluster head has not dead ever. As a cluster have head has been died it has been replaced by its vice Cluster head. Bakr et al. [2] have made focus mainly on extending the WSN lifetime. Lifetime has been extended by making WSNs redundant by adding spare nodes. The passive (switched off) spares has been made available to become active (be switched on) whenever any active WSN node energy exhausted. A new proposed LEACH-SM (LEACH Spare Management) has modified the prominent LEACH protocol by enhancing it with an efficient management of spares. Addition of the spare selection phase has been done in LEACH; this functionality has been named as spare management features in LEACH-SM. During Spare Selection phase, each node has been decided in parallel whether it would be become an active primary node, or a passive spare node. The nodes decided spares go asleep, while the WSN as the whole has been maintained the required above-threshold target coverage. (The spares have awakened when the probability that any primary node exhausted its energy reaches a predefined value.) Identification of spares alone has been increased energy efficiency for WSNs as proved, Decentralized Energy-efficient Spare Selection Technique has been used in spare selection phase by spare manger. Reduction in the duration of the active interval for cluster heads has been observed, considered as a side effect. Reduction energy consumption by cluster heads has been observed mainly. Chen and Wang (2012) [3] have explained an improved model in WSN which has been based on heterogeneous energy of nodes for same initial energy and multiple hop data transmission among cluster heads is proposed. New threshold has been introduced on the basis of current energy and average energy of the node to cluster head election probability and provide reliability that higher residual energy have greater probability to become cluster heads than that with the low residual energy. Problem of number of cluster heads reduces with the increase of the number of rounds. Confirmation has been provided with the approach that nodes with higher residual energy have greater probability to become cluster heads than that with the low residual energy. Extension in the network lifetime and guarantees a well distributed energy consumption model been demonstrated.

Katiyar et al.[4] have discussed regarding the unnecessary energy consumption due to the formation very small and big cluster at same. To overcome this problem a new protocol has been proposed named FZ-LEACH (Far Zone LEACH). Formations of Far Zones have been done to overcome the problem of uneven cluster formation. Far-Zone has been explained as a group of sensor nodes which are placed at locations where their energies are less than a threshold. An improvement in the performance has been observed in terms of Energy dissipation rate and network lifetime. Melese et al. [5] have explained the energy consumption of sensor nodes in Wireless sensor network. Main effort has been done for balancing the energy consumption across the network so that survival time of all nodes can increase. Optimization of the power consumption has been focused by taking consumed energy as a major factor for criteria cluster head selection. Energy consumption factor have contributed more effectively in increase network life time of WSN rather than residual energy. By considering energy consumption, new formula has been proposed to calculate threshold value. In order to optimize energy consumption and increase network life time, it is necessary to balance energy among nodes has been summarized. Extension in the LEACH formula has been done on the basis of a component that includes the consumed energy of each nodes of WSN, An increase in network life time has been observed. Major impact has been seen in the cases when long distances occurred between the base station and the nodes. Remarkable improvement has been concluded for cluster head selection. Peng et al [6] have proposed a new technique in which adaptive clustering hierarchy algorithm has been proposed to meet QOS (Quality of Services) requirements. Modification has been done in basic LEACH and an improved protocol has elaborated in which improvement has been occurred in the energy efficiency and other QOS parameters by excluding the node with improper geographic location to be the cluster heads. The optimum measuring range of head nodes has been designed to be a criterion of cluster head selection, and every cluster heads has been elected according to the node density threshold, which is defined by the node distribution situation process and communication among nodes. An Improvement has been shown in the network lifetime and the communication quality by selecting the Cluster head in the area of proper node density. Achieve good results when there is uneven distribution of nodes. Sun et al. [7]has proposed a technique in which some implementation has done to basic LEACH, named as ILEACH.ILEACH has based on the characteristic of limited energy of wireless sensor networks to prolong the lifetime of the Whole networks. Consideration of Nodes for cluster head selection has been done on the basis of residual energy. The constraint threshold of distance has used to optimize cluster scheme. Construction of the routing tree has been proposed on the basis of Cluster heads' weight. A tree based routing has been done in which a cluster head is elected as root node and the criteria for selecting root node is to be closer to the base station and owing enough energy. A better performance in both network life time and cluster head election has been drawing out as a conclusion.

Tao et al. [8] have represented a hierarchy based protocol in Wireless Sensor Network. A new energy-efficient protocol has been discussed by employing the cluster member energy threshold factor to restrict the formation of very big and the small clusters at the same time. Conceptualization of energy rating mechanism has been done to avoid uneven energy distribution; calculated energy also has been also taken into account to minimize the energy consumption of cluster members. An enhancement has been done by taking the consideration of three factors: Unbalanced Clusters, Uneven Energy Distribution and Unnecessary Energy Consumption when Cluster Head is dead. Hierarchical or multi-hop routing approach has been used to receive data from the cluster head nodes to the BS. Cluster heads have programmed such a way that they form a multi-hop backbone for transmitting data among cluster heads until they reach the BS. An Algorithm has been concluded a significantly increases the network lifetime Yektaparast et al. [9] have proposed a technique in which they have divided the clusters into equal parts, called as cell. Every cluster divided into 7 cells. Each cell has contained a cell head which is responsible for direct communication with Custer Head. Cell head has aggregated the native member's information in that cell and Communicate with Cluster Head, and prevent sensors unnecessary redundant information to Cluster Head. An improvement also has been done in computation of the threshold value for a cluster-head selection Formula. Node residual energy has been Considerate during cluster-head cell-head selection process that is responsible for maintaining the balanced energy consumption of the sensor network. Approach has been significantly improved the network lifetime and optimized the energy consumption . Kashafet al. [10] It has two feature one is it is reactive and another is it have three level of heterogeneity. It contains three types of nodes which contain the different energy level with this it have new feature i.e. reactive means it used hard and soft threshold to transfer the data. All nodes sense the environment continuously but the data transmission is done only when sensed value reach the HT and for second it considers the difference between new sense value and previous sensed value is equal to ST. Network lifetime in increased along with the threshold concept A. Manjeswar et al. [11] used in time critical application . It is first reactive routing protocol for WSN.TEEN's working is similar to LEACH expect at every cluster head change time, CH broadcast two threshold value one is HT and another is ST values.HT is absolute value of attribute on which it start data transmission if the data occurs in the range of interest and ST is small change in the previous sensed value. By introduction of HS values the energy dissipation is reduces and throughput is improved. Manjeshwar et al. [12] have presented a new protocol Adaptive Threshold sensitive Energy Efficient sensor Network protocol also called APTEEN. It extensive the rules of Teen which is a hybrid protocol for both periodic up data collection and also for time significant data collection. Here the cluster head broadcast four types of messages to the sensor node, threshold values, the attributes value, count time and an arrangement method for the nodes. It offered data regularly and also supplied information on time significant actions. It combined the best feature of both proactive and reactive network. G. Smaragdakis et al. [13] SEP introduced the two tier heterogeneity in which some fraction of nodes to the total number of nodes are considered to be Advance nodes with some additional energy level and rest of nodes are Normal nodes that having the energy less then advance nodes.SEP is based on weighted election probabilities of each node to become a cluster head according to the remaining energy of each node. With more energy level nodes in SEP, it increase the stability period and prolong the network life time. Femi A et al. [14] ESEP is an extension of SEP protocol that contains the three different types of sensor nodes- Normal nodes, advance nodes and intermediate nodes. As in SEP, Advance nodes having the energy greater than normal nodes and the intermediate nodes and fraction of nodes with energy level between the advance nodes and normal nodes called Intermediate nodes and rest of nodes are normal nodes. Probability of node to become a CH is calculated according to its energy level. With the introduction of more level of energy nodes stability period and network life time of WSN is increased. Li Qing et al. [15] presented a new protocol Distributed energy-efficient clustering also called DEEC. This protocol was used for heterogeneous WSNs which are based on clustering. Cluster-heads selection depends on the ratio between remaining energy of each node and the average energy of WSNs. In this protocol, node containing more energy has more probability to be a cluster head. DEEC does not need full energy information at every time though the choice of cluster head. It improves the Lifetime of WSNs and more successful messages delivery than existing clustering protocols in heterogeneous circumstances. DEEC has proved to be better protocol for multi-level heterogeneous WSNs.

3. MOTIVATION

In the present body, research is done in the area of WSN, the use of reactivity has been neglected by the most of researchers i.e. most of the protocol are proactive in nature and most of the work is done on three level of heterogeneity of nodes. Scalability of nodes and diameter is also neglected. We feel that there exists a network that respond immediately and also have more level of heterogeneity of nodes so that current requirements can be fulfilled.

4. PROPOSED ALGORITHM

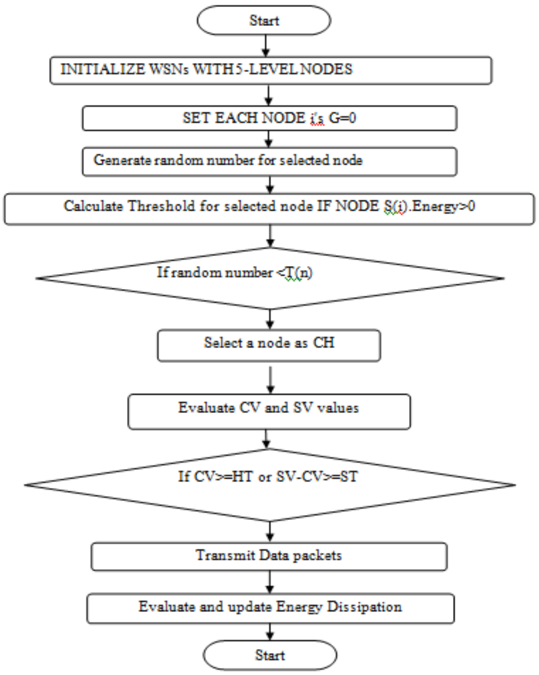

Fig 1: Flowchart of the proposed algorithm

5. RESULTS AND DISCUSSIONS

5.1 TEST SCENARIO 1 WITH SCALABILITY ISSUE(100*100 AREA WITH 250 NODES)

a) Stable period

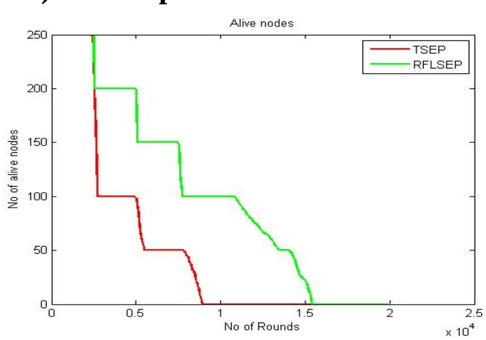

Figure 2: Stable Period under Scalability Issue

Table 1: First node dead time of TSEP and RFLSEP

Protocols	First node dead time
TSEP	2345
RFLSEP	2486

Figure 2 shows the comparison of total number of alive nodes of TSEP and RFLSEP. X-axis represents the total number of rounds.Y-axis represents the total number of alive nodes. Table 1 shows that first node for TSEP and RFLSEP dies at 2345 and 2486 round respectively. It clearly depicts that the RFLSEP efficient than TSEP in terms of network lifetime with increasing the number of sensor nodes.

b) Network lifetime

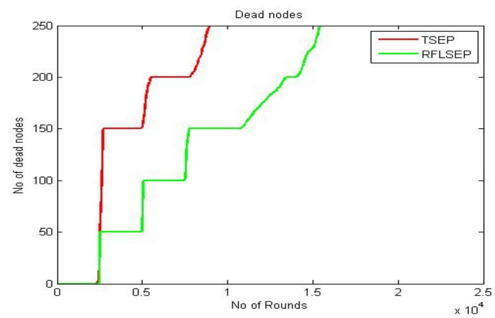

Figure 3: Network Lifetime under Scalability Issue

Table 2:Last node dead time of TSEP and RFLSEP

Protocols	Last node dead time
TSEP	8944
RFLSEP	15465

Figure 3 shows the comparison of total number of dead nodes of TSEP and RFLSEP. X-axis represents the total number of rounds. Y-axis represents the total number of dead nodes. Table 2 shows that all nodes for TSEP and RFLSEP die at 8944 and 15465 round respectively. It clearly depicts that the RFLSEP efficient than TSEP in terms of network lifetime while increasing the number of sensor nodes.

c)Throughput

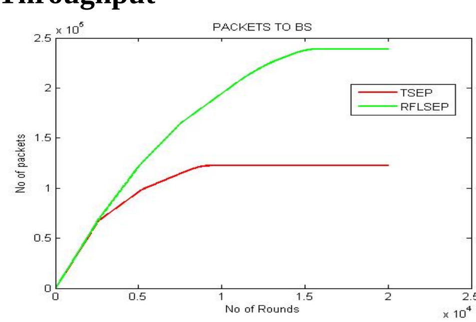

Figure 4: Packet sent from cluster head to base station

Figure 4 shows the comparison of throughput RFLSEP and TSEP. X-axis is representing the total number of rounds. Y-axis is representing packets sent to base station. It represents that data sent to base station is more for RFLSEP than TSEP. Thus this figure clearly shows that the RFLSEP is most efficient than TSEP in terms of packet sent to base station.

Figure 5 shows the comparison of throughput RFLSEP and TSEP. X-axis represents the total number of rounds.Y-axis is representing packets sent to base station. It represents that data sent to cluster head is more for RFLSEP than TSEP. Thus this figure clearly shows that the RFLSEP is most efficient than TSEP in terms of packet sent to cluster head.

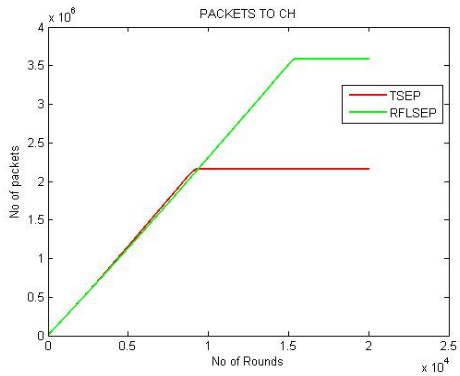

Figure 5: Packet sent from cluster head to base station

5.2 TEST SCENARIO 4 WITH DIAMETER AND SCALABILITY ISSUE(250*250 AREA WITH 250 NODES)

a)Stable period

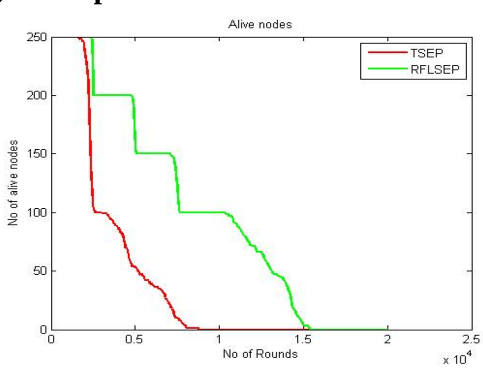

Figure 6: Network lifetime under both diameter and Scalability Issue

Table 3: First node dead time of TSEP and RFLSEP

Protocols	First node dead time
TSEP	1593
RFLSEP	2405

Figure 6 shows the comparison of total number of alive nodes of TSEP and RFLSEP X-axis is representing the total number of rounds.. Y-axis represents the total number of alive nodes. Table 3 shows that first node for TSEP and RFLSEP dies at 1593 and 2405 round respectively. It clearly depicts that the RFLSEP efficient than TSEP in terms of network lifetime with increasing the number of sensor nodes and area also.

b) Network Lifetime

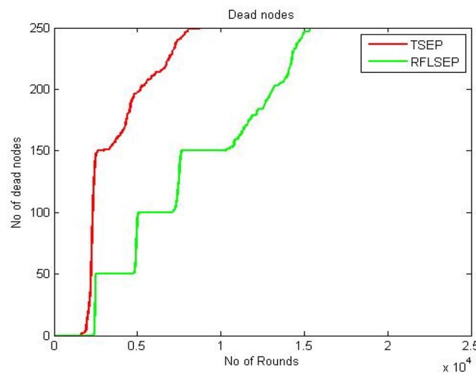

Figure 7: Network lifetime under both diameter and Scalability Issue

Table 4: last node dead time of TSEP and RFLSEP

Protocols	Last node dead time
TSEP	8798
RFLSEP	15424

Figure 7 shows the comparison of total number of dead nodes of TSEP and RFLSEP. X-axis represents the total number of rounds.Y-axis represents the total number of dead nodes. Table 4 shows that all nodes for TSEP and RFLSEP die at 8798 and 15424 round respectively. It clearly depicts that the RFLSEP efficient than TSEP in terms of network lifetime while increasing the number of sensor nodes and area also.

c)Throughput

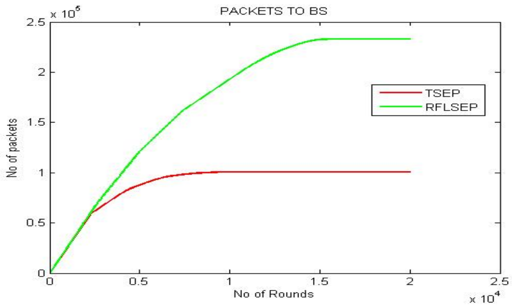

Figure 8: Packets sent from cluster head to base station

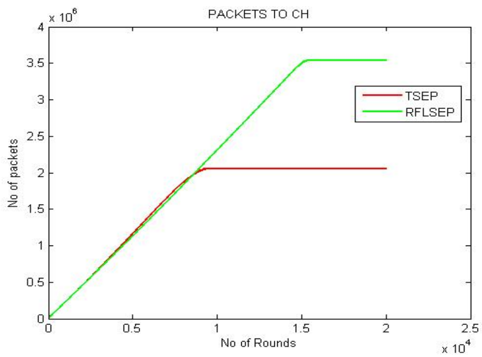

Figure 9: Packet sent from sensor node to cluster head

Figure 8 shows the comparison of throughput RFLSEP and TSEP. X-axis is representing the total number of rounds. Y-axis is representing packets sent to base station. It represents that data sent to base station is more for RFLSEP than TSEP. Thus this figure clearly shows that the RFLSEP is most efficient than TSEP in terms of packet sent to base station.

Figure 9 shows the comparison of throughput RFLSEP and TSEP. X-axis is representing the total number of rounds. Y-axis is representing packets sent to base station. It represents that data sent to cluster head is more for RFLSEP than TSEP. Thus this figure clearly shows that the RFLSEP is most efficient than TSEP in terms of packet sent to cluster head.

5. CONCLUSION AND FUTURE SCOPE

To increase the TSEP protocol further, this paper has increased the level of heterogeneity from three level to five level protocol. The five level TSEP raises the stable region of three level TSEP for clustering hierarchy process in heterogeneous sensor networks. To evaluate the proficiency of the proposed protocol the TSEP and proposed TSEP protocol has been designed and implemented in the MATLAB using data analysis toolbox. Various scenarios have been considered to ensure the proficiency of the proposed algorithm. The performance analysis has shown us how the proposed five level TSEP has efficient outcomes over traditional three level TSEP. Also due to five level heterogeneity the proposed protocol seems to be more realistic than the available one. This work has not focused on the effective data aggregation. Many WSNs data aggregation at the base station by individual nodes causes flooding of the data which consequences in maximum energy consumption. Also most of data aggregation methods are either based upon the clustering or tree based approach but the use of hybrid data aggregation has been ignored by the most of the researchers. So in near future we will modify the Five level TSEP by using the hybrid data aggregation.

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