PROTOCOLS USED FOR REDUCING ENERGY CONSUMPTION WITHIN WSN: COMPARATIVE STUDY

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Abstract-- Wireless sensor network revealed many opportunities for the researchers to minimise energy consumption of the sensors. Sensors have limited energy associated with them. This means when they are used to transmit packets energy is consumed and after some packet transmission, complete energy dissipates and network ultimately dies down. Many researchers towards conservation of energy has been conducted. To this end, this paper presents many different protocols like LEACH, DEEC, SEP and TDEEC. These protocols are discussed along with the results to evaluate the performance of these protocols in this paper. The parameters like energy efficiency, packet drop ratio, packets to cluster head, packet to base station are considered within the result section. It is concluded that DEEC protocol is best among these protocols and result by 5% is better in terms of energy efficiency.

Keyword-- *WSN, LEACH, DEEC, SEP, TDEEC , lifetime, packet to base station, packet to cluster head*

I. INTRODUCTION

Wireless sensor network presents communication mechanism with the help of sensors. These sensors ensure that routing is proper among source and destination. (Priyadarshi *et al.*, 2020)The only problem is the limited energy associated with the sensors. The sensors lose energy quickly as the packets are transmitted by the sensors. To minimise the energy consumption many distinct protocols are researched over. In almost every protocol, cluster head is selected having maximum energy and it will be used in order to transmit the packets towards base station. Cluster head will be changed with the every round.

(Amgoth, Jana and Thampi, 2015)In LEACH protocol, most of the nodes transmit the packets to the cluster head. The aggregation takes place at the cluster head from there; data is transmitted towards base station. This protocol assumes that each node has powerful radio to transmit the packet towards the base station. The node that is selected as cluster head cannot be selected as cluster head again for 'P' rounds.

(Shah, Javaid and Qureshi, 2016)In SEP, stable election is conducted to declare the cluster head. The election considers several parameters to declare a node as cluster head. The cluster head transmit the information towards the base station. The cluster head must have high energy, low distance from the base station and high centrality.

(Izadi, Abawajy and Ghanavati, 2015)In DEEC, distributed clustering scheme is followed. In this case, nodes do not transmit the information directly to the base station. Rather packets are transmitted only by the cluster head close to the base station. This means even cluster heads do not transmit the packets to the base station. The cluster head that is close to the base station is allowed to transmit the packets.

(R. Kumar, 2014)TDEEC protocol is time based distributed energy efficient clustering protocol. The protocol uses the DEEC mechanism but with the slotted time ways. The packets will be transmitted in slots of time. Every cluster head is assigned with the particular time during which transmission do takes place. The lifetime of the network improves using this mechanism.

Rest of the paper is organised as under: section 1 presented the introduction of protocols used to achieved energy efficiency. Section 2 gives the literature survey of the protocols used to achieve energy efficiency, section 3 gives the result section using the listed protocols, section 4 gives the conclusion and future scope.

II. LITERATURE SURVEY

This section provides the detail of the protocols used to achieve the energy efficiency. Packet drop ratio is decreased using protocols like LEACH, DEEC etc. in addition lifetime of the network is increased considerably.

(Amgoth, Jana and Thampi, 2015)The LEACH and SEP steering conventions focused on remote sensor systems are highlighted in this paper. The quantity of sensor hubs in WSN is adequate and a solitary hub is incredibly constrained in asset. The chief goal of the steering convention configuration is to propel the vitality proficiency and delay the system lifetime. This paper has chosen the LEACH steering convention as our exploration center to break down the particular execution of the directing calculation, vitality of sensor hubs and system lifetime. MATLAB organize re-enactment device is utilized to reproduce the steering convention and information investigation. (Shah, Javaid and Qureshi, 2016) proposed to utilize connections to upgrade arrange operations as far as

vitality efficiency and information quality for information accumulation applications. We introduce a novel approach that utilizations spatial relationships between geographic neighboring hubs to shape maximal inner circles. At that point, we apply it to convention LEACH by adding a pre-determination stage to choose delegate hubs in every club to be initiated for LEACH operations. Matlab simulations demonstrate significant change of vitality efficiency of our proposed convention LEACH-SC, while it jellies information quality spoken to by the quantity of information bundles conveyed to the base station and the bunch heads, and the system scope proportion in examination with convention LEACH. (Mahajan, 2016)Discussed Low Energy Adaptive Clustering Hierarchy (LEACH) convention is considered as a standout amongst the most essential conventions that are every now and again utilized as a part of the Wireless Sensor Network (WSN). Numerous conventions were created to alter and enhance the LEACH convention. The multi-bounce strategy (MHTLEACH) is one of these conventions, which seemed to enhance the execution of the LEACH convention. In this paper, an enhanced multi-trust strategy (IMHT-LEACH) is proposed. Rather than appropriating all the Cluster Heads (CHs) into two levels as in the MHT-LEACH, the IMHT-LEACH disperses all the CHs into various levels. It recommends another system to course the information to the Base Station (BS) through the levels.

Recreation comes about show that the IMHT-LEACH enhances the lifetime, solidness and throughput of the WSN contrasting and the customary LEACH and the MHT-LEACH conventions

(Heinzelman, Chandrakasan and Balakrishnan, 2000) Wireless Sensor Network Consists of substantial number of sensor hubs, which are associated through remote medium has developed as a historic innovation, which offers the capacity to gauge the physical world parameters precisely. Right now there are some unique kind of directing conventions are intended for sensor systems. All of these directing conventions have considered the vitality effectiveness as the goal keeping in mind the end goal to augment the life time of the entire sensor arrange. So far the current directing conventions accessible in Wireless Sensor Networks (WSN) are information driven, progressive, and area construct and with respect to request steering conventions. As WSN comprises of a gathering of utilization particular sensors, the viable utilization of vitality requires effective steering conventions. The group based convention are Deterministic vitality effective bunching (DEC), SEP-E are most appropriate as far as vitality productivity. (Izadi, Abawajy and Ghanavati, 2015)Wireless Sensor Networks (WSNs) contain various sensor hubs having restricted power asset, which report detected information to the Base Station (BS) that requires high vitality use. Many steering conventions have been proposed in such manner accomplishing vitality efficiency in heterogeneous situations. Notwithstanding, every convention is not reasonable for heterogeneous WSNs. Efficiency of convention debases while changing the heterogeneity parameters. In this paper, we first test Distributed Energy Efficient Clustering (DEEC), Developed DEEC (DDEEC), Enhanced DEEC (EDEEC) and Threshold DEEC (TDEEC) under a few distinct situations containing abnormal state heterogeneity to low level heterogeneity. We watch altogether in regards to the execution in light of strength period, arrange life time and throughput. EDEEC and TDEEC perform better in every single heterogeneous situation containing variable heterogeneity as far as life time, however TDEEC is best of just for the steadiness time of the system. Be that as it may, the execution of DEEC and DDEEC is exceedingly affected by changing the heterogeneity parameters of the system.

(S. Kumar, 2014)Many directing conventions on grouping structure have been proposed as of late. In late advances, accomplishing the vitality proficiency, lifetime, sending of hubs, adaptation to non- critical failure, idleness, in short high unwavering quality and vigor have turned into the fundamental research objectives of wireless sensor arrange. Many steering conventions on grouping structure have been proposed as of late in light of heterogeneity. We propose EDEEC for three sorts of hubs in dragging out the lifetime and security of the system. Thus, it builds the heterogeneity and vitality level of the system. Re-enactment comes about demonstrate that EDEEC performs superior to anything SEP with greater soundness and successful messages.

(Grids, 2016)in given that in wireless sensor network there is an involvement of an important number of inexpensive power constraint sensors which gather the data from the surrounding and transmit towards the sink (base station) in a supportive way extending the lifetime of wireless sensor network and reducing the energy consumption impose a huge challenge. For these purposes, clustering techniques are largely used. They propose and evaluate a clustering process called DDEEC (developed distributed energy efficient clustering) scheme for the heterogeneous wireless sensor network. The probability of cluster based election with more efficiency is described in this technique.

(Nadeem, 2013)in proposed an Adaptive Reliable MAC protocol. This protocol is based on TDMA scheme which is supportive in reducing the consumption of energy. For communication, this protocol pass on Guaranteed Time Slot to each of its sensor nodes based on the demands of sensors nodes. They also advised a system that uses the periodic sleep for reducing the eavesdrop. They also estimated a topology called star topology in which centralized node gathers the information from the sensor node and broadcast with monitoring station directly or by the Access point.

(Pati *et al.*, 2016)given that to reduce the consumption of energy there is the main technique called clustering algorithm. This technique improves the life period of the

network and improves the scalability. Efficiency in the energy is also the prime focus. Clustering technique is best suitable for the heterogeneous network. This type of clustering technique is called DEEC (distributed energy efficient clustering technique). In the clustering scheme, the network is divided into the small area called cluster and in each cluster, there is a cluster head which gains the (Cheikh *et al.*, 2014)In said that in the upcoming time, WSNs require a great need of spreading the nodes and also enhance its applications in all fields because in the future most of the devices will be connected to each and everything. So spreading of these nodes is the greatest challenge, keeping this in mind a new protocol is given called TDEEC used for the heterogeneous network. TDEEC protocols use three levels of heterogeneity. It is a reactive protocol and used basically for reactive networks. Reactive networks are those which react quickly to any change arise in any parameter.

(Chand, Singh and Kumar, 2014)in proposed the EDEEC for enhancing the lifespan and the stability of the network. To enhance the heterogeneity is the main concern. It works on three level of nodes i.e. Simple nodes, advanced nodes, and supernodes. It improves the performance of the network. They revealed that it is much better than the SEP protocol.

(Shang, 2009)in proposed intelligent routing protocol for WSN called energy efficient sleep and awake protocol. In their assigned technique, they evaluate and enhance the many issues like stability, network lifespan and cluster head selection. The main focus is to enhance the selection process of the cluster head. The cluster head is elected on the basis of residual energy. In their proposed protocol nodes switch between sleep and awake mode depending on the situation of the nodes in a network whether transmitting data or sit idle. They revealed that this protocol performs efficiently than SEP, DEEC, LEACH.

The result section is presented after this section. From this section it is concluded that DEEC protocol is best in class for energy conservation. The result section is given as under

III. PERFORMANCE ANALYSIS AND RESULT

In this section, simulation is conducted and result is written in terms of plots. The result section considers the following setup

Parameter	Meaning
Initial Energy	5 Joules
Packets to base station	0
Packet to cluster head	0
Dimension	100x100

information from all the cluster nodes. Estimation of the selection of cluster head depends on the remaining energy and the average energy of the network. Simulation results reveal that DEEC protocol improves the lifespan of the network and reduce the consumption of the energy, in short, improve the overall performance of the network.

Amplification Energy	0.5 J
Initial distance of nodes	0.1

Table 1: Initial parameters for the network

The network is designed in such a way that distance between the nodes is minimized. The transmission of packets has to be maximized which is the prime objective of every protocol considered for evaluation.

First of all we compare the lifetime of the network in terms of rounds. The rounds are maximized in case of DEEC and minimized in case of LEACH. The lifetime initialized as 5000 rounds. This means

Protocol	Lifetime
LEACH	2709
SEP	3200
TDEEC	3700
DEEC	4570

Table 1: Lifetime of the network in terms of rounds

The plots for the lifetime for the network are given in figure 1. The lifetime of the network is maximized in DEEC. Slotted TDEEC has relatively low lifetime as compared to DEEC.

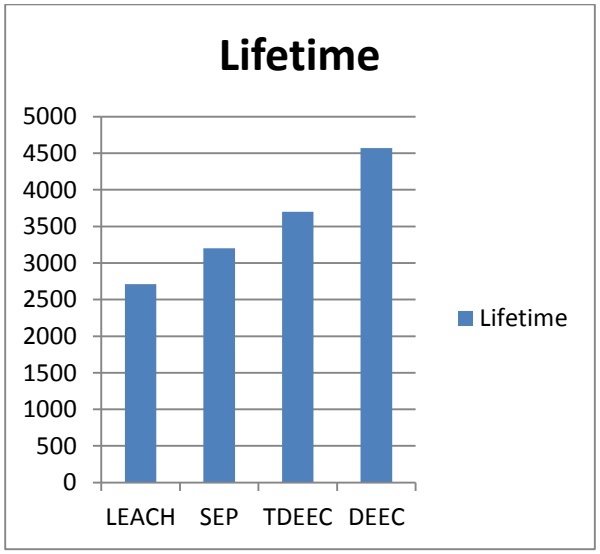

Figure 1: Result in terms of lifetime of the network

The packet to base station indicates the total packets transmitted to the destination. The source is a cluster head. The lifetime of the network impact this parameter. In fact, higher the lifetime of the network more will be the packets transmitted. It is given within table 2

Protocol	Packets to base station
LEACH	27098
SEP	30909
TDEEC	38909
DEEC	49087

Table 2: Packet to base station

The plots corresponding to the packets to base station is given in the figure 2.

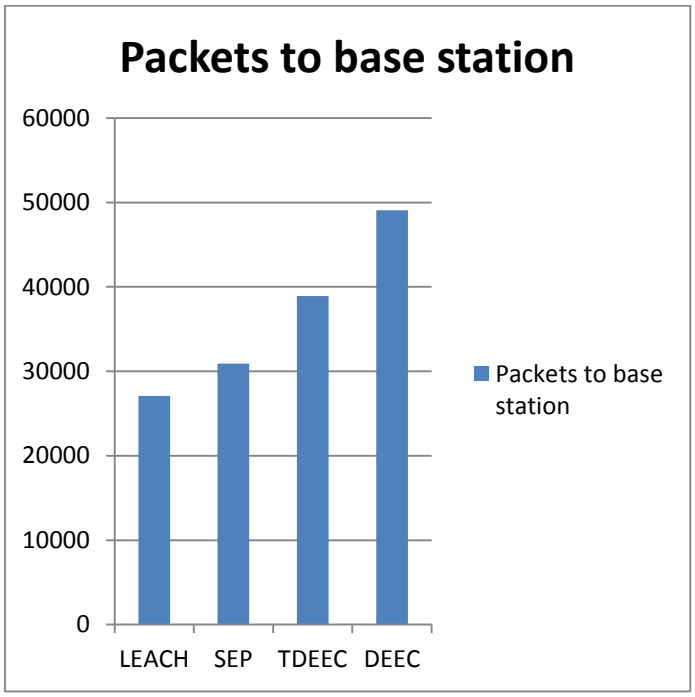

Figure 2: Packet to base station

Packet to cluster head is initial parameter as compared to packet to base station. Packet to cluster head is aggregated at the cluster head. Cluster head received the packets as long as it has capacity. As the energy dissipates packets will be lost. Packets to cluster head is given in table 3

Protocol	Packets to Cluster head
LEACH	50909
SEP	55678
TDEEC	63456
DEEC	65678

Table 3: Packet to cluster head

The packet to cluster head is plotted in figure 3. The plot indicates that maximum number of packets is transmitted from the source to destination.

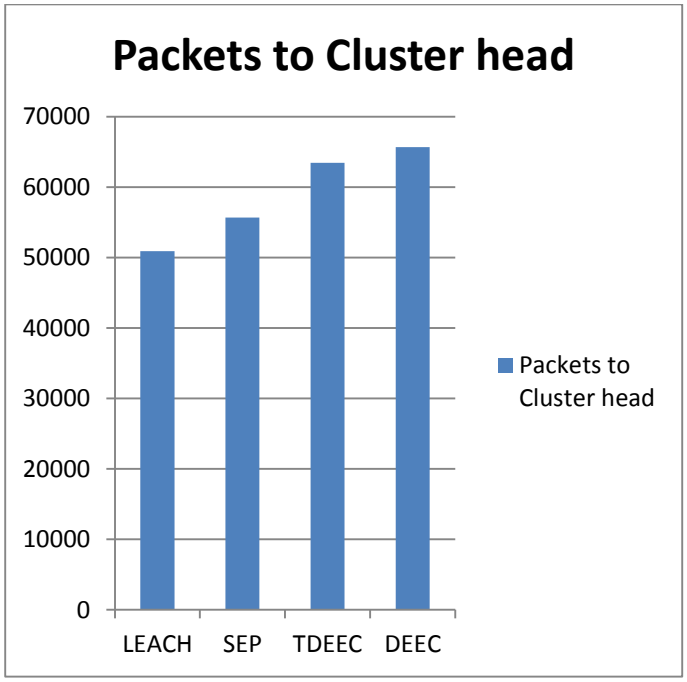

Figure 3: plots for packets to cluster head

The plot for the packets to cluster head indicates that DEEC protocol is better as compared to other protocols.

IV. CONCLUSION AND FUTURE SCOPE

The energy efficiency for the DEEC protocol is better as compared to other protocols. The mechanism for the transmission in every protocol is aggregation. The aggression causes high energy dissipation. Energy dissipation can be reduced in case distributed mechanism for transmission is followed. The DEEC protocol outperform every other protocol since only few cluster heads which are closer to base station are selected for transmission. The DEEC protocol however does not employee any compression mechanism hence packet transmission is poor. The energy efficiency can be further improved in case priority queue and compression is applied simultaneously. In future priority queue along with RLE compression can be applied for result enhancement.

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