Implementation of DEEC Protocols in WSNs using Matlab

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Abstract - Wireless sensor Networks (WSN) advancements have been employed in recent years for monitoring purposes in various areas from building industry to our home surroundings because of their capacity to brilliantly screen remote areas. In this paper, we have built up an absolutely deterministic model that uses clustering to sort out the WSN. We propose a deterministic energy efficient clustering protocol that is dynamic, distributive, self-sorting out and more energy efficient than the current protocols. It uses a simplified approach which minimizes computational overhead-cost to self-sort out the sensor arrange. Our simulation result demonstrates a superior execution concerning energy utilization, which is reflected in the system lifetime in both homogeneous and heterogeneous settings when contrasted and the current protocols. It is deserving of note that our approach approximates a perfect answer for balanced energy utilization in hierarchical WSN.

Keywords - Internet of things, Optimal secured energy aware protocol, WSNs, DEEC, EDEEC, DDEEC.

I. INTRODUCTION

Wireless sensor network represents the group of sensor network where the size of network can vary from a few to thousands [1-3]. Sensors relates the physical world to the virtual by sensing the surrounding environment then converting this information into a digital form then send it to the base station for the further processing [3,11]. Wireless sensor network consist of a large number of sensor nodes, which are connected wirelessly to collect the information from the sensing field.

Clustering of sensor nodes can balance the load among sensor nodes which increase the network lifetime of sensor nodes in Wireless Sensor Network [8]. The modern technology development in the field of sensor design, material used and other ideas make the size smaller and compact of sensors and sensor arrays with lower cost [10,12]. Wireless sensor technology has potential for sensing and monitoring in not only science and engineering but also in a wide range of applications in military, structure health, industrial, child care, medical monitoring, food processing, surveillance and in many more fields [13,15].

II. LITERATURE REVIEW

In [16], the authors presented propose online heuristics for public data delivery in smart city settings and also introduce a pricing utility function for data acquisition. There pricing function considers resource limitations in terms of delay, capacity and lifetime on the data provider's side, as well as user's quality and trust requirements from the requesters' side. The simulations associated with delay, lifetime of a node were performed. In this method authors failed in showing the stability and convergence of network.

In 2016, Zhang Bing et al. [17] have embraced the Enhanced - Channel-Aware Routing Protocol (E-CARP) to make the organization of Internet of Underwater Things. The standard goal considered in this experimentation was the accomplishment of modest information sending and less vitality utilization framework. Moreover, the proposed strategy has tended to the fundamental issues from the traditional Carp technique that does not take after the reusability property and PING-PONG strategy that chooses the hand-off hub when the system is in relentless state. The simulation results were taken which have given the system minimum correspondence cost and high ability. The main drawback of this method is authors failed to provide security among the nodes.

Shelby et al. [18] have offered a routing protocol for IoT systems that explains how to route the data via Internet among non-internet sensors or devices. The efficacy of the trust assessment procedure was mainly directed using dependence source, as that controls the burden in the procedure as well as the function of WSNs was predominantly responsive for burden because of the minimized energy.

In 2016, Tie Qiua et al. [19] have carried a Greedy Model with Small World (GMSW) in order to maintain the robustness of the IoT structure with expanded execution. At to start with, the nearby significance of the hubs was dictated by the voracious criteria. Here, they considered that the attainability of the streamlining calculation was gotten by the little world model. The speed of the GMSW calculation to get to the system with modest number of alternate ways can be accomplished through the execution assessment of the proposed with the current techniques. The method is applicable for smaller networks which is the main drawback.

III. MOTIVATION

In many routing algorithm cluster head plays important role in choosing the best set of cluster headsets to ensuring the prolonged network lifetime. While there are many factors are considered by the researchers to develop the routing protocols for WSN such as average energy of the network, residual energy, probability of the being elected as CH, distance between the sensor nodes to the base station etc. Along with the sensing, data transmission in the wireless sensor network consumes the most of the power of the sensor nodes. The lesser transmission lowers the energy consumption, which results in prolonged lifetime of network. This research focuses on using TEEN concept for optimization of data transmission after the cluster formation

in which the CH election is done according to EDDEEC protocol(Enhanced Developed DEEC purposed by N. Javed et al [14]) for three-level heterogeneous WSNs.

IV. SIMULATION RESULTS AND DISCUSSION

A. Parameter - To evaluate the performance of throughput, the numbers of packets received by BS are compared with the number of packets sent by the nodes in each round.

Table 1: Characteristics of the test network

Parameter	Value
Network Size	100m * 100m
Number of nodes	100
Packet Size	2000 bits
Initial Energy	0.5 j
Number of rounds	5000
Transmitter Electronics (ETX)	50nJ/bit
Receiver Electronics (ERX)	50nJ/bit
Data Aggregation Energy	5nJ/bit

B. Simulation Results - The simulated protocols are briefly summarized here. In DEEC, nodes organize themselves into clusters using the distributed algorithm described in chapter 6.1. This protocol has the advantage of being distributed, self-configuring and not requiring location information for cluster formation. In addition the steady-state protocol is low-energy. However, the drawback is that there is no guarantee as to the number or placement of cluster-head nodes within the network and number of cluster members within a cluster.

For this simulation each node begins with only 0.5 J of energy and an unlimited amount of data to send to the base station. Each node uses equation 3.2 to determine the cluster-head status at the beginning round. The rate at which the data is transferred to the base station and the amount of energy required to send the data to the base station are tracked. Since the nodes have limited energy, they use up this energy during the course of simulation. Once a node runs out of energy, it is considered dead and can no longer transmit or receive data.

For this simulation, energy is removed whenever a node transmits or receives data and whenever it performs data aggregation. Quality is an application-specific and data-dependent quantity, one application-independent method of determining quality is to measure the amount of data (number of actual data signals or number of data signals represented by an aggregated signal) received at the base station. The more data the base station receives, the more accurate its view of the remote environment will be. If all the nodes within a cluster are sensing the same event, the actual and effective data will contain the same information and there is no loss in quality by sending effective events, the cluster-head will pick up the strongest event (strongest signal within the signals of the cluster members) and send that as the data from the cluster. In this case, there will be a loss in quality by aggregating signals into a representative signal. In the proposed algorithm loss in quality can be more than LEACH because the data may be aggregated twice before they are sent to the base station. If the distance between nodes within a cluster is small compared to the distance from which events can be sensed or if the distance between events occurring in the environment is large, there is a high probability that the nodes will be sensing the same event.

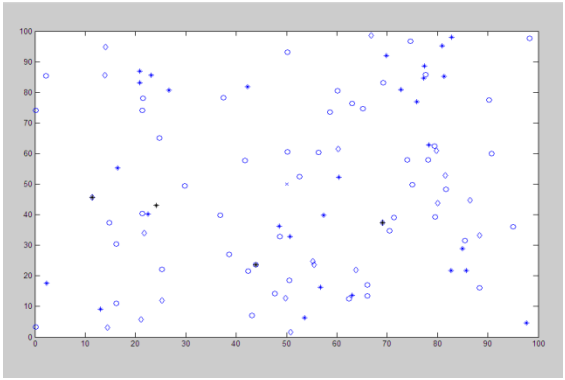

Figure 1: Distribution of sensor nodes in DEEC

Figure 1 shows the distribution of sensor nodes in LEACH. Both the cluster head and member nodes are homogeneous in nature i.e. they have same amount of initial energy. Figure 2 shows distribution of sensor nodes in the proposed protocol. Here the cluster head and member nodes are heterogeneous in nature i.e. they have different amount of initial energy.

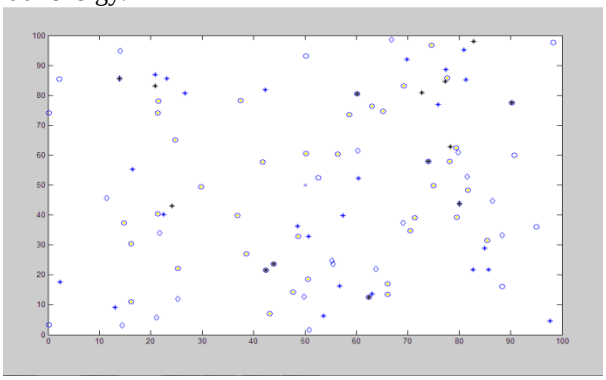

Figure 2: Distribution of sensor nodes in proposed protocol

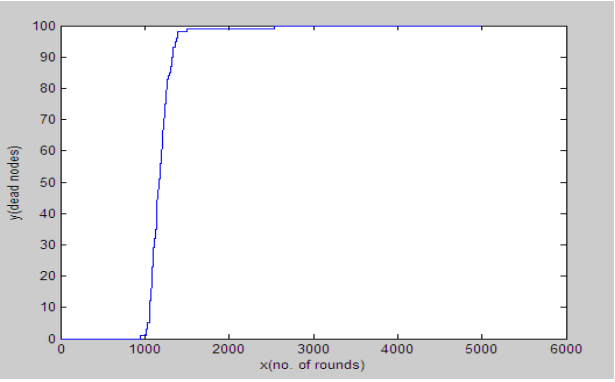

Figure 3: Dead nodes in DEEC

Figure 4 shows the total number of nodes died over the simulation round. If the total number of nodes that are dead

after each round is plotted in the proposed protocol then the graph of figure 5 is obtained.

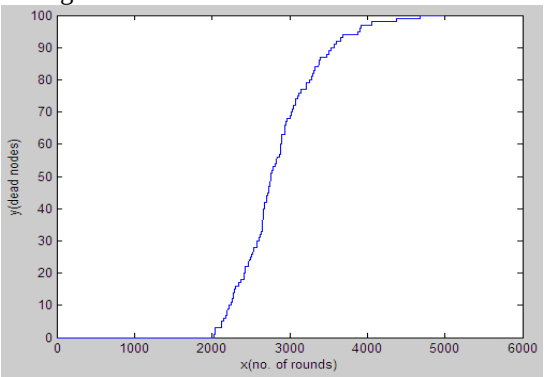

Figure 4: Dead nodes in proposed protocol

The fig.6 and fig.7 show the total number of nodes that remain alive over simulation time of 5000 rounds for both the routing protocol. It can be seen that nodes remains alive for a longer time (rounds) in proposed Leach-protocol than the existing Leach protocol.

Quality of routing protocol is depending upon the date (actual data signal) successfully transfer to Base station. If data received by Base station is increasing it means quality of routing protocol is getting better and better. Figure.5.8 and fig 5.9 show the quality analyzing clustering routing protocols.

As data to Base station is important factor for quality analysis of any routing protocol, similarly data (data signal) to cluster-head is also important. Figure 5.10 and fig 5.11 show the data received by cluster-head.

From the simulation result shown above, an improvement table is drawn below which shows lifetime improvement on the basis of first node dead and all nodes dead.

Table 2: Comparison of LEACH and improved DEEC protocol

Protocol	Rounds when nodes start dying	Rounds when all nodes are dead
DEEC	950	2550
Improved DEEC	2020	4680

Comparatively result of DEEC , THRESHOLD DEEC and Improved DEEC.

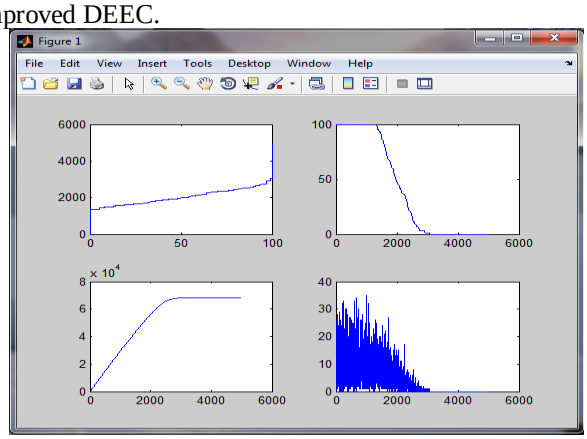

Figure 5: Fundamental Output of DEEC.

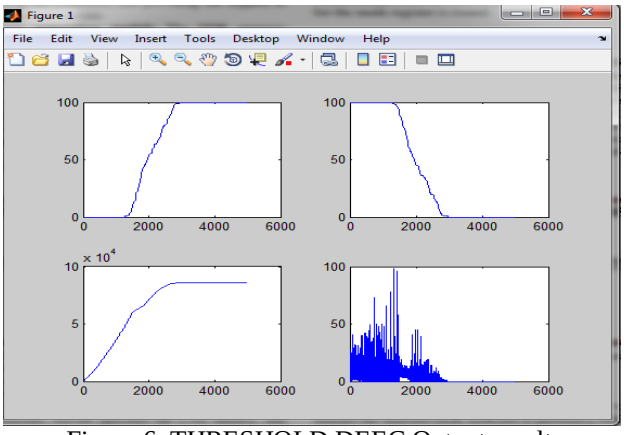

Figure 6: THRESHOLD DEEC Output result.

V. CONCLUSION

Use of the wireless channel is growing at an amazing speed. Advances in energy-efficient design have created new portable devices that enable exciting applications for the wireless channel. While the wireless channel makes deployment task easier, it adds constraints that are not found in a wired environment. Specifically, the wireless channel is bandwidth-limited, and the portable devices that use the wireless channel are typically battery-operated and hence energy-constrained. In addition, the wireless channel is error-prone and time-varying. Therefore, it is important to design protocol and algorithms for wireless networks to be bandwidth and energy-efficient as well as robust to channel errors. The work described in this dissertation shows an energy-efficient routing technique which is mainly suitable for application like environment monitoring where sensor nodes located in nearby region collect similar type of data

VI. REFERENCES

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