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An Extended Enhanced Distributed Energy Efficient Clustering for IOT based WSN routing protocols

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***Abstract:** The IOT sensor networks have been widely used over the past two decades for the upload of data on the cloud server. Since the battery is or is being operated by most sensors. The network's existence therefore depends on the network's energy needs. The IOT-WSN networks are intended to maximize energy efficiency. In past communications, the distributed energy efficient clusters (DEEC) protocol has been commonly used. Since during the routing of data on cloud servers most energy is used. This paper is therefore aimed at developing a long-term and energy efficient routing protocol. The key challenges are designing the network with better latency and efficiency to enhance the life of the entire network. Paper is mainly concerned with optimizing parameters of the network simulation for enhancing network life. Varying probability of node distribution of the current EDEEC protocol has been conducted in a variety of experiments. The present paper compares the performance of the DEEC protocol versions and the proposed Extended EDEEC protocol based on life nodes, cluster head numbers and packets transmitted to BS.*

*Keywords:-***Internet of Things, Wireless sensor network, Soil Sensing, Energy Efficiency, Clustering, Data aggregation, Routing protocols, network lifetime.**

I. INTRODUCTION

An IOT based sensors network are consist of sensors for data acquisition to communicate data from the field WSN over cloud server. The common approach of the energy efficiency improvement is to improve the node energy distribution pattern. Clustering based routing protocols [1, 3, 4] are widely been used for the improving the energy efficiency of the IOT based WSN networks. The lifetime of the IOT network depends on life of the sensor node battery power. Considering these challenge various types of routing techniques are studied in and reviewed in this paper. DEC, DEEC, EDEEC protocols are validated and evaluated and used for comparing the performance. Various performance measures like delay, throughput, latency, energy consumption and network lifetime are considered to present systematic study of routing protocols. The aggregation protocol that is based on clustering in WSN maximize overall network lifetime by minimize the communication.

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II. ENERGY DISSIPATION MODEL

The energy dissipation equation of nodes of IOT-WSN network for messages of L bits length over the transmission distance d to operate the network hardware is expressed as:

$$E_{Tx}(L,d) = \begin{cases} L \times E_{elec} + L \times \epsilon_{fs} \times d^2 & \text{if } d \le d_o \\ L \times E_{elec} + L \times \epsilon_{amp} \times d^4 & \text{if } d \ge d_o \end{cases} \quad (1)$$

Any routing protocol design's ultimate objective is to minimize the dissipation of network resources. In literature numerous protocols have been designed to direct the development of an EE. Section 2 discusses the remainder of the paper, which contains the first work to strengthen the EE of the WSN network. Existing protocol comparative analysis is also given, that compare different clustering based aggregation and protocols. At last conclusive summary provided that put the crystal clear study to give the future direction to the researchers in this particular field of wireless sensor networks of IOT.

A. Structure of WSN

The data is transmitted through several nodes and the data is connected to other networks with a gateway. Wireless sensor networks have attracted more than ever more in recent years in the fields of environmental monitoring, radiation and nuclear risk detection mechanisms, ship arms sensors, surveillance, military power, control, intelligence, intelligent cities, healthcare systems, automation, and targeting systems (WSNs). Agriculture is changing from conventional agriculture to technologically advanced agriculture. For agriculture, the Internet of Things (IOTs), including building of the farm information network, developing information technology for agriculture, and agricultural use of information resources will play a larger role in promoting agriculture information.

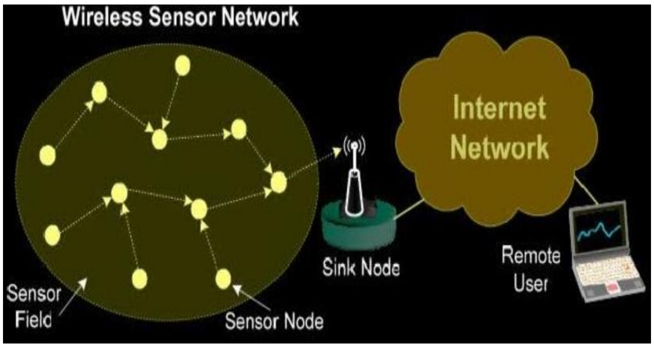

Fig.1.Structure of the WSN –IOT networks

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III. LITERATURE REVIEW

A lot has been done to boost the energy quality and service life of the heterogeneous networks. This paper typically concentrated on protocols based on the hierarchical clustering. The paper discussed mainly the work carried out in the field of distributed energy efficient protocols for clustering. Priya et al [2] proposed the DEEC Protocol on the basis of the distributed power clustering principle, initially using two normal tire and thus improving life efficiency at advance nodes for the distribution of energy. Priya et al. [1] suggested improved power production through the DEEC and the EDEEC protocol. An additional node layer has been added to boost performance.

T. N. Qureshi et al [3] have introduced an optimized energy-based efficiency protocol known as BEENISH, which is super-heterogeneous, but with dramatically improved network life. A better version of the LEACH-based clustering approach is developed by Arumugam et al. [4].

Khurana, et al. [5] have proposed a novel method for cluster head selection for LEACH-MAAC protocol. Method was specific for MAC protocol. Anamika chouhan et al [6] has designed a new approach of reserved nodes for designing the EDEEC protocol the concept called as R-EDEEC. They have improved the lifetime of the network using reserve node concepts. They have addressed that DDEEC protocol is having the low stability and lifetime period, and also having low throughput compared to an enhanced EDEEC protocol [1].

Mansi Panwar et al [7] have designed an improved version of the EDEEC protocol and named the algorithm as I-EDEEC. Authors introduced the periodic threshold based transmission of data for improving the performance. Sercan Vançin et al [9] has proposed to design a three tire based energy efficient routing based on balanced threshold sampling of DEEC protocol.

IV. EDEEC PROTOCOL VALIDATION

The energy-efficient distributed clustering protocol (DEEC) has been designed by implementing a definition of residual energy, using two node tyre probabilities as regular nodes and forward nodes. The inclusion of the third tyre of the idea of supper nodes strengthens this distribution of probability. The number of advance nodes, supper nodes and counts of regular nodes is indicated

$$normal = n * (1 - m); \qquad (2)$$

$$advance = n * m * (1 - mo) \qquad (3)$$

$$monaysuper = n * m * mo \qquad (4)$$

Table 1. Overview of Routing Protocols Analysis

Authors	Methodology	Approach
Priya et al [1]	The enhanced energy performance over the DEEC	Using extra supper nodes as third tire
Mansi Panwar et al [7]	Improved EDEEC protocol designing	Periodic threshold based transmission of data.
Sercan Vançin et al [9]	Design a three tire an energy based efficient routing	balanced threshold sampling
Proposed	Optimum parameters design for extended lifetime of EDEEC	Improving energy distribution for extending latency

The summary of review is given in the Table 1. The work is focused to improve the performance of the EDEEC protocol. Values of the initial transmitted and received energy and the node election coefficients for the standard ECEEC protocol is given n the Table 2 below.

Table 2. Energy and node distribution parameters for EDEEC protocol

Variable	Notation	Value
N	Number of the nodes	100
P	Initial probability of cluster heads	0.1
Eo	Initial energy in J	0.5 J
$E_{Yx} = E_{Ex}$	Transmitted and received energy	50 μJ
E_{fs}	Free space energy	10 pJ
E_{DA}	Data aggregation energy	5 μJ
A	Energy enhancement friction	3
r_{max}	Maximum number of rounds	2500 to 5000
m_0	Advance nodes friction	0.4
M	Normal nodes friction	0.5

The probabilities of cluster head selection correspond to Normal, advance and supper nodes are defied as;

$$p(i)_N = P * Eo\big(1 + m * (a + mo * b)\big) * Ea \qquad (5)$$

$$p(i)_A = P * (1 + a) * E(i)/(1 + m * (a + mo * b)) * Ea \qquad (6)$$

$$p(i) = P * (1 + b) * E(i)/(1 + m * (a + mo * b)) * Ea \qquad (7)$$

Therefore in order to increase the network lifetime in this paper an extended protocol is designed called as E-EDEEC. The network simulation parameters are optimally varied for improving the energy distribution of the network. It is observed that carefully choosing the coefficients of the advanced and supper node can improve the system performance. A modified supper node percentage factor is decided and constant c_s is set to 0.2 for network distribution. The equation 4 is changed to

$$super = n * c_s \qquad (8)$$

The advance node distribution m_o is set to 0.3, and the supper node coefficient for energy enhancement is set to b=5. It is observed the proposed modifications made significant improvement in the performance of protocol.

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V. RESULTS AND DISCUSSION

In this paper an extended performance is evaluated for the E-EDEEC protocol by optimum selection of simulation parameters. Many experiments have been performed on core 2 Duo 2.4 GHz processor in MATLAB software. The performance is compared based on the Alive and died nodes.

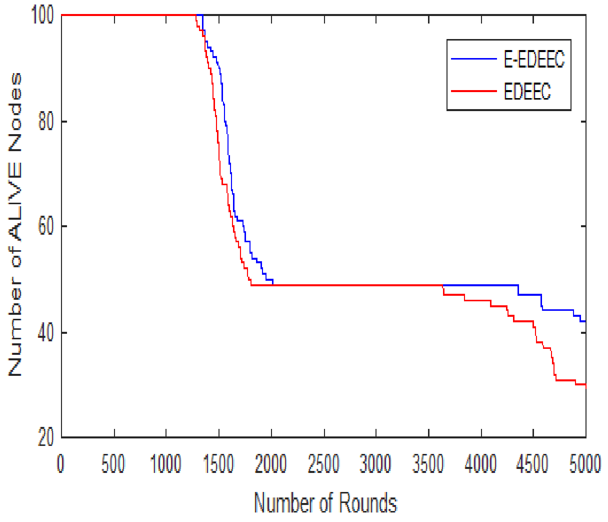

Fig.2. Comparison between the number of the EDEEC Alive Nodes and the improved –EDEEC – WSN Protocol

Experiment 1: Comparison of E-EDEEC vs EDEEC

The existing protocols performance is compared with modified extended protocol for number of alive nodes in Figure 2. For this experiment a=2, m=0.5 and m0=0.3 was fixed. The value of mo having significant impact on performance as it improves the election probability when reduced. Thus it can be observed from the Figure 2 that the E-EDEEC method gives improvement in network lifetime. Although the energy level is also improved much.

Experiment 2: Modified E-EDEEC vs EDEEC

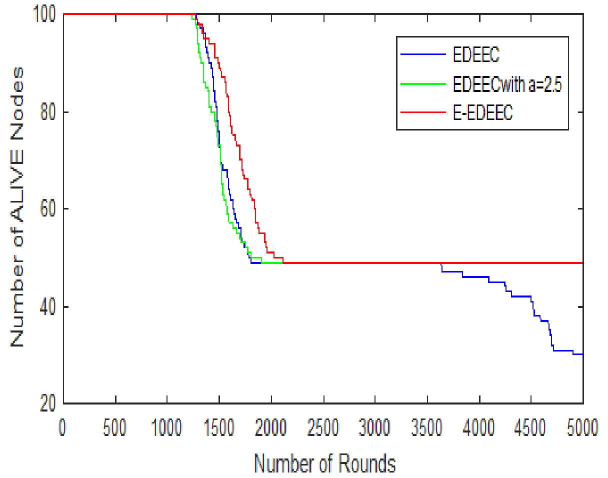

Fig.3.Comparison of Number of Alive nodes for different versions of EDEEC with proposed EEDEEC protocol.

In this experiment the value of the coefficient mo is varied and different versions of EDEEC protocols are compared. The numbers of live nodes are shown in the Figure 4 shows that the proposed method performs better in terms of the life of the network.

The number of the dead nodes performance is compared in the Figure 4. It can be observed that less nodes are died with proposed E-EDEEC protocol thus improves the energy distribution of the network.

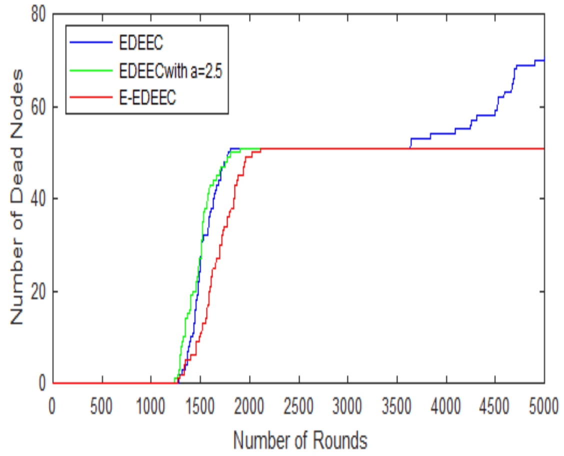

Fig.4.Comparison between the Number of the EDEEC dead nodes and the improved –EDEEC Protocol for WSN

Experiment 3. Packets Sent to S

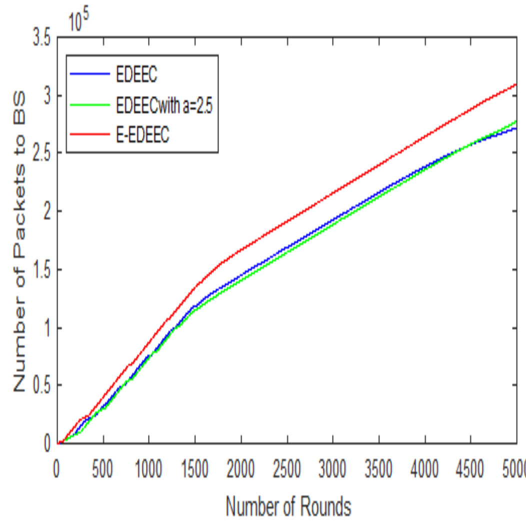

Fig.5.Comparison of Number of packet sto be transmitted to BS for various EDEEC with proposed E-EDEEC protocol.

It can be clearly observed from the Figure 6 that the approximately 16 to 20% more packets are transmitted with the our proposed method for the same energy requirement thus the energy is minimized.. The number of the CH sent to BS are compared to Figure 6 the proposed E-EDEEC protocol improves the CH counts.

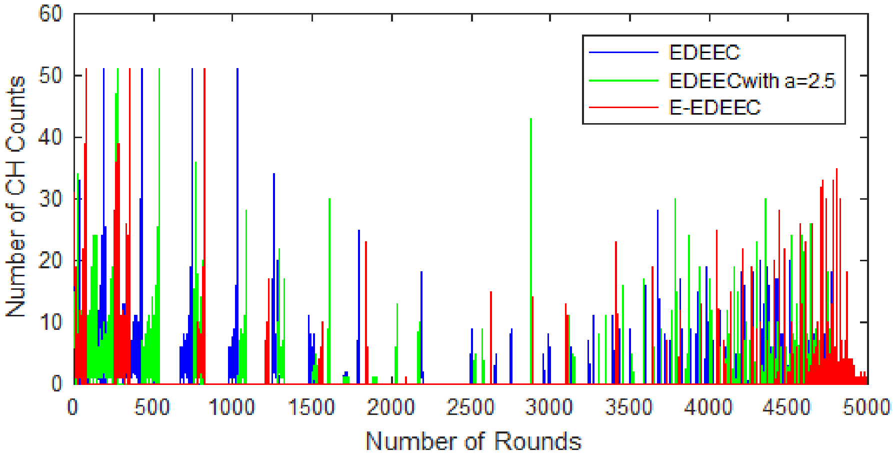

Fig.6.Comparison of the Number of cluster head (CH) counts for different versions of EDEEC with proposed EEDEEC protocol.

Experiment 4 Number of CH Counts

The number of cluster heads (CH) are shown in this experiment in figure 6. The proposed solution clearly enhances and expands CH counting efficiency in comparison with the EDEEC protocol. Especially at the start of rounds and at the end of rounds.

VI. CONCLUSION AND FUTURE SCOPE

The networks of wireless sensors are the essential field in which IOT is a problem for the need for energy-efficient routing and communication. To have appropriate protocols and techniques from time to time suggested by different researchers. Various common protocols such as LEACH with its various updated version, TEEN, PEGASIS, SPIN, Guided Diffusion, COUGOR etc are available. The comparative study of these protocols is performed on the basis of certain performance measures such as network delay, power, success rate, latency, energy consumption and network life. The importance of data aggregation and limitations of data aggregation also discussed in this paper. The protocols also rely on the structure of wireless sensor networks, which also includes the influence of the architecture analysis. This paper explores the overview analysis of various protocols and techniques that will enable researchers to establish a new protocol. In future, various performance measures should be well performed in the next protocol.

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