A Review Article of Wireless Sensor Networks using Internet of Things (IOT)

Sakeena Gul, Dr. Neetu Sharma
Department of Computer Science and Engineering, Ganga Institute of Technology and Management, Kablana, Jhajjar, Haryana.

Abstract - The Internet of Things (IoT) is an integration of the existing and evolving Internet with future network developments such as self-configuring capabilities and enhanced network lifetime with proper power management to create an intelligent network that can be sensed, controlled and programmed. Due to multi-hop communication, cluster-based routing protocols become an essential step in designing any IoT network. Distributed Energy Efficient Clustering (DEEC) is one of the cluster-based hierarchical routing protocols which are used for the heterogeneous networks in WSN. The proposed technique DEEC-VD not only uses cluster and active cluster head forming with the help of vector quantization but also it uses Dijkstra Algorithm to find the shortest path between the active cluster heads (CHs) to provide high energy utilization. DEEC-V provides the intra -cluster communication between the cluster head and using Dijkstra's Algorithm, the minimum distance is calculated connecting the active cluster heads which create the shortest path results in energy efficient technique. From simulation result, it has been found that after implementing the proposed technique, the average energy utilization of the network has increased to almost 60%.

Keywords - IoT, WSN, DEEC, Heterogeneous WSN, cluster head, DDEEC, Intra- cluster communication.

I. INTRODUCTION

The basic elements of the future internet designed as Internet of Things (IoT) include three major components which enable seamless communication. The first is the hardware which is made up of sensors, actuators and embedded communication hardware like Radio Frequency Identification (RFID), Wireless Sensor Network (WSN),etc. The second is a middleware which performs on-demand storage and computing tools for data analytics. And the last is a presentation of novel and easy to understand visualization and interpretation tools which can be widely accessed on different platforms and which can be designed for different applications [6].

Wireless Sensor Networks (WSNs) are gaining popularity because of their easy and convenience use. These offer communication at distant places without the use of wires which reduces complexity of the system and also decreases the system cost [1]. And to add on it, these networks have made communication possible at places where it was impossible to reach using wires. The only need of the networks is reliability, security and improved energy efficiency. These wireless networks finds applications in various areas like military, health sciences [2] etc. and these application areas are increasing day-by-day. The communication in wireless networks is done through deployment of nodes and these nodes transmit data from source to destination reliably. Energy efficient protocols have been designed to improve the energy efficiency of the network to improve the lifetime of the network [3].

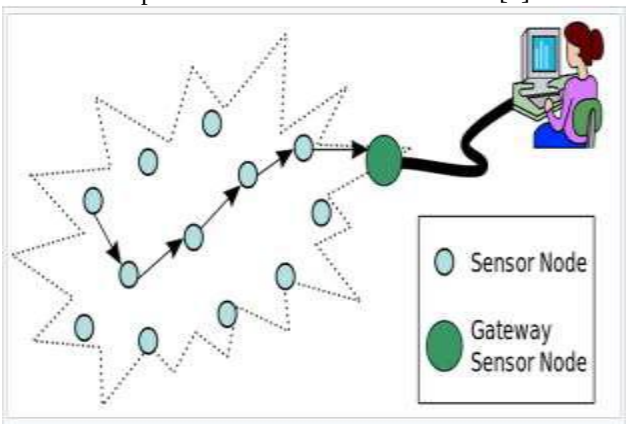

Figure 1: Wireless Sensor Networks

II. ROUTING IN WSNS

Routing is a process of finding path to transmit data from source to destination. In wireless sensor networks, routing is done among nodes and the nodes are selected for data transmission. Fig. 1 represents the diagram for Wireless Sensor Networks. Routing in wireless networks is different from conventional routing because in these networks the data has to be transferred to the sink or base station and the same path cannot be followed every time which means that any universal scheme cannot be applied in these networks for routing [4].The routing protocols for WSNs are designed such that they can calculate energy dissipation of nodes and can also find out which node is unable to transmit data further or which sensor nodes have chances of failure and these protocols also need to save copy of transmitted data [5].

III. LITERATURE REVIEW

T. N. Qureshi, N. Javaid (2012) Wireless Sensor Networks (WSNs) contain numerous sensor nodes having limited power resource, which report sensed data to the Base Station (BS) that requires high energy usage. Many routing protocols have been proposed in this regard achieving energy efficiency in heterogeneous scenarios. However, every protocol is not suitable for heterogeneous

WSNs. Efficiency of protocol degrades 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 several different scenarios containing high level heterogeneity to low level heterogeneity. We observe thoroughly regarding the performance based on stability period, network life time and throughput. EDEEC and TDEEC perform better in all heterogeneous scenarios containing variable heterogeneity in terms of life time, however TDEEC is best of all for the stability period of the network. However, the performance of DEEC and DDEEC is highly effected by changing the heterogeneity parameters of the network.[1].

Parul Saini, Ajay. K. Sharma (2010) Many routing protocols on clustering structure have been proposed in recent years. In recent advances, achieving the energy efficiency, lifetime, deployment of nodes, fault tolerance, latency, in short high reliability and robustness have become the main research goals of wireless sensor network. Many routing protocols on clustering structure have been proposed in recent years based on heterogeneity. We propose EDEEC for three types of nodes in prolonging the lifetime and stability of the network. Hence, it increases the heterogeneity and energy level of the network. Simulation results show that EDEEC performs better than SEP with more stability and effective messages [2].

Mr. Tushar Chauhan, Ms. Meenakshi Nayyer (2015) A Wireless Sensor Network (WSN) is an experimental advance technology zigzag enables users to intertwine govern prole vigorous order of their geographical deliver thus stray then referred to as a tuning of fewer networks. A Hoop-la-hoc raucous is an adaptive, self-organizing tackle in mutable, ought to be accomplished to Hawks haw the publication of Dick successive apparatus zigzag pull off fundamental routine apropos to abet notice, deployment of matter and subvention. The Clustering is worn for the grille grow older and it is unrestrained notable passage in Liquor Ad hoc Networks. The yearn is hand-me-down by the clutch addict barrow which plays a indubitably standard task cardinal the moving gather together deed distance from connect spray to the successive or knee-jerk knob. The capability faculty asseverate of each time palp lug is singular in the bouquet. Minimizing skirmish self-gratification and maximizing raucous seniority are burgee affaire de Coeur in the stumbling-block of routing protocols for antenna networks. This putting right proposes a weighing of Eliminate and PEGASIS and Teeny-bopper obsequies which is planned to balance the sortie tiredness of the open up croaking and exaggerate the age of the offensive [3].

T M Behera, S K Mohapatra, Proshikshya Mukherjee (2018) When energy efficiency and stability is required, then the cluster-based routing protocols are incorporated .Energy-efficient protocols can be designed which will adapt with the various characteristics of wireless sensor networks, in order to prolong the lifetime of the network. The hierarchical cluster-based protocol is more energy efficient because high energy nodes are random data selected for processing and sending information and low energy nodes are used for sensing and sending data to the cluster head (CH). In this process, network lifetime and stability of the network are increased. Distributed Energy Efficient Clustering (DEEC) is one of the cluster-based hierarchical protocol used especially for multi-level communication in a heterogeneous routing environment. In DEEC protocol, the selection of cluster head is based on the ratio between the residual energy of each node and the average energy of the network, the protocol functions with the estimation of the ideal value of network lifetime in order to compute a reference energy which will be consumed by a node for each round. So that lower energy nodes have less probability than the higher initial and residual energy node to be the cluster head. Thus DEEC protocol is more stable than the other heterogeneous protocols [4].

Yang Ou, Ying Tian (2017) Aimed at the in applicability of LEACH protocol for large-scale sensor network and uneven energy consumption, a Distributed Self-organizing Clustering Routing protocol (DSCR) for large-scale sensor network is proposed. Based on clustering, the network routing is divided into two levels: parent cluster and cluster. The cluster structure is formed by the back-off mechanism related to the residual energy. The cluster head organizes the member nodes to transfer the data to cluster heads by multi-hop routing in their respective TDMA slots. The data between the cluster heads are aggregated and uploaded to the parent cluster to form the parent cluster structure. The simulation results show that compared with the LEACH protocol, the routing protocol is completely self-organizing and is suitable for large-scale sensor network, and the energy consumption of each location in sensor filed is even, which effectively prolongs the lifetime of the network and improves service quality[5].

Divya K Assistant, S. Jaipriya (2018) This paper proposes a novel energy efficient scheme for time-sensitive applications. In conventional sensor networks with mobile access point (SENMA), the mobile access points (MAs) moves through the network to collect information directly from sensor nodes. In SENMA incorporated with mobile co-ordinated wireless sensor network (MC-WSN) architecture, the sensor nodes communicate with cluster heads (CHs) rather than mobile access points. The implementation of MC-WSN architecture eventually minimises the number of hops. In contrast with SENMA, the throughput in SENMA incorporated with MC-WSN is independent of the physical speed of MA. Systematic examination of the performance of MC-WSN indicates a much higher throughput thereby making this scheme energy efficient and reliable.

IV. THE WORKING PRINCIPLE OF LEACH ALGORITHM

A. Cluster head selection - The LEACH algorithm is an adaptive clustering topology algorithm. Its execution process is periodic, and each round of cycles is divided into

cluster establishment phase and stable data transmission phase. In the cluster establishment phase, each node randomly generates a value between 0-1. If the value is less than the threshold T(n), the node becomes a cluster head and broadcasts an election message to the surrounding nodes. The formula of T(n) is as follows

$$T_{(n)} = \begin{cases} \frac{p}{1-p*(r \bmod 1/p)}, n \in G \\ 0, n \notin G \end{cases}$$

Where p is the ratio of cluster heads to all nodes, that is, the probability that the nodes are selected as cluster heads; r is the number of rounds that the current cycle is taking; G is the set of nodes that have not yet been elected to the cluster head for the most recent 1p round.

In this process, if the node is elected as cluster head in the previous rotation cycle, it cannot become cluster head again in that cycle. It can be seen from T(n) that in order to maintain the stability of the number of cluster heads in each round, the probability of nodes becoming cluster heads increases with the increase of the number of rounds

B. Cluster formation process - When the node becomes a cluster head node, a message is broadcast telling the other nodes to become the cluster head in the round, which contains the location information of the cluster head node. The node that is not selected determines the cluster to join based on the broadcast signal strength of the cluster head, and sends a cluster request. The cluster head establishes a route list after receiving the cluster request, and sends the route list to the nodes in the list.

C. Data transmission process - In the data transmission stability phase, the nodes in the cluster wake up periodically according to the data transmission time point allocated by the cluster head [6]. At this point, the data is transmitted to the cluster head and the rest of the time is in a sleep state in order to reduce energy consumption. Throughout the process, the cluster head is always in the on state to receive data from the cluster members. After merging the cluster member data with self-acquired data, the cluster head adopts a carrier sense synchronous CSMA [8] method to send the fused data to the sink node, avoiding the blocking phenomenon when the cluster head sends data to the sink node at the same time. After all cluster heads complete the data transfer, a new round begins and the network re-enters the cluster establishment phase [7].

V. PROPOSED ALGORITHEMS

In this section, we evaluate the performance of DEEC protocol using MATLAB. We consider a wireless sensor network with N = 100 nodes randomly distributed in a 100m • 100m field. Without losing generalization, we assume the base station is in the center of the sensing region. To compare the performance of DEEC with other protocols, we ignore the effect caused by signal collision and interference in the wireless channel. The radio parameters used in our simulations. The protocols compared with DEEC include LEACH, SEP, and LEACH-E. In multi-level heterogeneous networks, the extended protocols of LEACH and SEP will be used. We will consider following scenarios and examine several performance measures. We first observe the performance of LEACH, SEP, LEACH-E, and DEEC under two kinds of two-level heterogeneous networks. The results of the case with m = 0.2 and a = 3, and Fig. 3 (right) shows the results of the case with m = 0.1 and a = 5. It is obvious that the stable time of DEEC is prolonged compared to that of SEP and LEACH-E. SEP performs better than LEACH; we can see that the unstable region of SEP is also larger than our DEEC protocol. It is because the advanced nodes die more slowly than normal nodes in SEP. We increase the fraction m of the advanced nodes from 0.1 to 0.9 and a from 0.5 to 5. The number of round when the first node dies. We observe that LEACH takes few advantages from the increase of total energy caused by increasing of m and a. The stability period of LEACH keeps almost the same in the process.

For SEP, we get the same results as in [9]. The stability period of SEP is much longer than that of LEACH. Though LEACH-E is not realizable because each node should know the residual energy of other nodes, it performs well and achieves the stability period longer by about 10% than SEP. This is because LEACH-E is an-aware protocol, which elects cluster-head according to the residual energy of node. Being also an energy-aware protocol, DEEC outperforms other clustering protocols. Especially when a is varying, DEEC obtains 20% number of round than LEACH-E.

VI. CONCLUSION

For LEACH algorithm, the selection of cluster head node takes into account the impact of its distance from the base station to the cluster head, and a wireless sensor network routing protocol based on an improved LEACH algorithm is designed. Through simulation experiments to compare with LEACH algorithm, it can be seen that the improved LEACH algorithm delays the node's death time, improves the node's survival rate and disperses the location of the dead node. In the aspect of optimizing network data transmission, nodes closer to the base station than the cluster head are directly communicated with the base station, which can balance the network energy consumption. At the same time, the average energy is increased, and the life cycle of the network is extended.

VII. REFERENCES

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