ANALYSIS OF VARIOUS WIRELESS SENSOR NETWORK (WSN) METHODS BASED ON CLUSTER HEAD SELECTION AND ROUTING

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Abstract

Wireless Sensor Networks (WSNs) are used to sense the data and communicate with others by wireless. The nodes involved in this network consist of small and minimum powered. To process their function, these nodes organised and configured itself. In recent year WSNs are used many applications due its features such as low cost, easy - deployment, flexibility and efficiency. Even though it has best features lifetime of network and security of routing are still challenges one in WSNs. These challenges exit because of insignificant cluster head (CH) selection and insufficient trustworthy path selection. So, it is necessary to analyse various routing and cluster head selection techniques to propose a new method to solve these challenges. This paper reviewed the various techniques of CH selection and routing methods based on some parameters such as methodology, contribution, existing methods used and result of their work. Finally, we produced analysis of various techniques based on the following parameter: energy consumption, throughput and lifetime.

Keywords: Wireless Sensor Networks (WSNs), Cluster Head(CH), Energy Consumption, Throughput, Lifetime.

I INTRODUCTION

Wireless Sensor Network (WSN) had been developed as a standout amongst the vast and well-known innovations for future usage. It is empowered as a further advantage in innovation and accessibility of little, economical, and smart sensors that brings practical and effortlessly deployable WSNs. A WSN has expansive quantity of cooperating small-scale nodes, known as sensor nodes. It is spatially dispensed and works together for imparting of data which is collected from monitored field using remote connections. The information collected by various nodes is sent to the sink. This will be utilized the information regionally or associated with other different networks. WSN technology offers various features of curiosity through traditional networking solutions, such as, minimum cost, high-scalability, maximum reliability, higher accuracy with flexibility, and comfort of organization which empower its utilization in an extensive variety of assorted applications. It also includes progressions in sensors and new technology that helps to obtain smarter, smaller, and less expensive wireless sensors. Lots of wireless sensors are being deployed in many applications such as in military, environment, healthcare, and security.

Every node is made with minimum power consuming devices, embedded-processor, power unit and communicating-channels or transform media. Generally these immerse processor is utilized for combining and handling the information which is received from devices. Moreover, those sensor nodes are equipped with constrained resources. Sensor components deliver a specific response to make changes in the physical conditions such as temperature, humidity and so forth. The wireless transform media provides an intermediate, to interchange the packets that is gathered from the wsn node to the external node. At the time of designing WSN application, a sensor node will have a limited transmission range, constrained battery power and the lifetime of the system will be affected with an essential issue. So, to solve this issue and to extend the prolonging of the network, power of the sensor node can be used.

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II ROUTING IN WSN

A major important aim of WSN is to report pre-determined natural events or to transfer information obtained from deep nodes for additional investigation. These are playing a role of a data originator and router. That is, the sensors nodes hear the data and transfer the data to the sink via single-hop or multi-hop. Since, the sensor node carries imperfect and unalterable battery resources, broadcast should save energy. Designing router contracts on WSNs is challenging due to a number of network issues that emphasize energy efficiency.

Many of the algorithms of the network of sensory networks focus on finding energy proficient methods to transport the period of sensory networks. Ideally, the nerve power in effective mechanisms is depleted quickly, so sensory networks cannot watch events from other parts of the target area. Therefore, appropriately, route algorithms should take into account the efficiency of the energy, as well as the quantity of energy left in each sensor, and then away from the inactive sensors due to timely exhaustion. Data transfer is an important source of power consumption and is a major challenge in designing a cost-effective route network to extend network life.

III ROUTING CHALLENGES IN WSN

- The strategy function of WSN routing-protocols is simply interesting due to many features that separate these from wireless infrastructure-less networks. A few types of routing problems are involved in WSNs. Some of the key challenges are outlined below.

- It is almost impossible to provide a global identifier scheme with a large number of sensory nodes. Therefore, wireless sensors cannot use classified IP-based protocols.

- Flow of acquired data is mandatory from multiple sources to a particular base-station. But this is not happen on normal networks.

- Data-traffic has a high frequency in mostly multiple sensory areas can produce the same data at hearing. Therefore, it is important to use such negligence in route contracts and to use available bandwidth and power as competently as probable.

In addition, wireless motes are strictly limited in relation to transmission-power,band width size, storing and internal board power. As a result of such differences, a number of new routing mechanisms have been developed to address these route challenges in wireless nerve networks.

IV REVIEW OF EXISTING WORK

Ahmed et al. (2018)[1] to seek sink node proposed a novel KNN classification method with whale optimization. Because sink node collects all information from all sensors and also maintain the lifetime of network. In this research calculation of fitness function used as main parameter to predict the best location with high residual energy to maintain lifetime. Experimental result proved the performance of proposed method. Finally proposed method increase 11% of lifetime of network

Lee et al. (2019)[2] proposed the Sampling-based Spider Monkey Optimization and Energy-efficient Cluster Head Selection (SSMOECHS) method for solving the issues such as computational time, poor accuracy and replica node caused by location-based approach by selecting the energy-efficient cluster head. So, the newly proposed method improves the lifetime and firmness of the WSNs. This research described the way of selecting cluster-head and sampling approach by using Spider Monkey Optimization (SMO). The tested results are compared with the existing similar methods such as Low-Energy Adaptive Clustering

Hierarchy%Centralized (LEACH-C), Particle% Swarm% Optimization Clustering (PSO-C) protocol, and SMO based threshold-sensitive energy-efficient delay-aware routing protocol (SMOTECP). The proposed method had proven the better result than existing methods. Finally, it increases the lifetime and stability.

Wang et.al (2019)[3] introduced genetic algorithm with optimal leach energy efficient method to find the optimized route based upon fitness value. Hierarchical leach method is used to predict the cluster head. GA is used to find the best route. Simulation results proved the efficiency of proposed method with reduced energy consumption rate.

Arora et.al(2019)[4]introduced novel energy efficient and self-organized Ant Colony %Optimization (ACO). In his work cluster head selection depends on maximal energy. Multiple paths developed in between cluster head and members of ACO after that dynamic route are created. The final execution results proved that the newly proposed methods network has the better lifetime.

Rahiminasab et. al.(2020)[5]proposed a novel method which depends on multi-feature decision making. It considered the four issues such as energy efficient, distance to base station and data queues length. To solve these issues Cluster Splitting %Process (CSP) algorithm and the Analytical% Hierarchy% Process (AHP) methods have been used. Then these issues are examined by proposed method. The experimental result shown the better result than existing Base station Controlled Dynamic% Clustering%Protocol (BCDCP) method. The energy consumption decreased and lifetime of WSNs increased by new approach.

Umbreen et. al (2020) addressed the problems basedon inappropriate selection of cluster head. Most of the clustering protocols are dedicated to prolonging of network lifetime[6]. But it doesn't focus the selection criteria for CH, stable clustering, more energy consumption. So, it needs to address these issued to introduce a new clustering technique. To solve these issues the proposed method focused on energy efficient and flexibility-based cluster head selection. In this approach, the cluster head selection is on the following criteria such as mobility of nodes, energy residual, distance to sink and adjacent node. The simulation result of proposed method shows the better result than existing method such as CRPD, LEACH, and MODLEACH.

Visu et.al (2020) developed energy efficient Dual Cluster Krill Herd Optimisation (DC-KHO) method to solve the problems in conventional methods such as packet delivery delay, time and high costs. Suitable solution only based on optimization. In the existing methods, the random selection path for transmission has been delayed with end-to-end process and energy consumption noted high[7]. Thus, this research selects an optimal route based on path trust value. This proposed method overcoming the challenges caused in the time of transmission, time of computational and residual energy.

Safa's et. al(2021) introduced IE2 -LEACH method to address the issue lifetime of node[8]. This work focused to enhance LEACH by selecting cluster head based on energy consumption. The degree of energy consumption is improved with the help of effective cluster head selection. The proposed method developed based on extend the lifetime of network. So, it can be any other clustering approach. Instead of selecting the CH randomly the new technique has used in the proposed approach. The experimental result shows the significant result than existing.

Jagan et.al (2022)[9] introduced fully connected energy efficient clustering (FCEEC) approach. The proposed method creates a completely connected network which is based on the distance of the path and selected Cluster Head (CH) based on electrostatic discharge method. It will

increase the lifetime of network with the help of electrostatic discharge approach. FCEEC reduced the count of dead nodes. So, it increased the network lifetime. The performance of the proposed method evaluated by energy consumption, packet delivery rate and dead node count.

Author & Year	Contribution	Methodology	Network Type	Evaluated with exiting Method	Result
Shankar et al., (2016) [19]	To attain a comprehensive search with quick integration for energy-efficient CH selection	Hybrid HSA and PSO Harmony Search Algorithm (HSA) and Particle Swarm Optimization (PSO)	Heterogeneous	LEACH DT HAS PSO	Energy Consumption 72.89% Throughput:67.23% Lifetime: 65.12%
Rao et al., (2017)[20]	To maintain the nodes energy to extend the lifetime of network	PSO-ECHS	Homogeneous	E-LEACH LEACH-C PSO-C LDC	Energy Consumption 80.89% Throughput:77.23% Lifetime: 73.12%
Lee et.al(2019)[1]	To solve the poor computation time, low accuracy based on location approach	Sampling-based Spider Monkey Optimization and Energy-efficient Cluster Head Selection (SSMOECHS)	homogeneous and heterogeneous	LEACH-C PSO-C SMOTE CP	Energy Consumption 63.29% Throughput:81.23% Lifetime: 77.12%
Mu et.al (2019)[16]	It focused on diffusion-based routing only.	Directed Diffusion Routing consider Query-based Routing (DDRQR)	homogeneous	LEACH, LEACH-C	Energy Consumption 62.89% Throughput:83.23% Lifetime: 80.12%
Arora, et.al (2019)[8]	No consider node security	Novel energy efficient and Self-Organized Ant Colony Optimization (NSOACO)	homogeneous	E-LEACH LEACH PSO	Energy Consumption 72.89% Throughput:80.23% Lifetime: 76.12%
Jagan, et.al(2022)[2]	To set up fully Connected Shortest path routing	novel Fully Connected Energy Efficient Clustering (FCEEC) mechanism	homogeneous	LEACH-C BO-LEACH ESD	Energy Consumption 86% Life Time: 32.28% Throughput:66.32%
Rahimina sab et. al(2020)[3]	To select an appropriate cluster head	Cluster Splitting Process (CSP) algorithm and Analytical Hierarchy Process (AHP) method	Homogeneous	BCDCP LEACH LEACH-C	Energy Consumption:85.34% Throughput: 85.14% Lifetime:78.24%
Abduroh man et.al (2020)[18]	No focus on Data Security and node security. It focused on lifetime of network.	Modified E-LEACH Routing Protocol	Homogeneous	E-LEACH LEACH	Energy Consumption:94.34% Throughput: 86.14% Lifetime:80.24%
Visu et.al (2020)[11]	It doesn't focus the shortest path	energy efficient Dual Cluster Krill Herd Optimisation (DC-KHO)	Homogeneous	LEACH-C BO-LEACH ESD	Energy Consumption:88.34% Throughput: 87.14% Lifetime:83.24%
Safa's et.al(2021)[4]	To enhance LEACH by identifying proper CH based on energy	IE2 -LEACH	Heterogeneous	E-LEACH LEACH	Energy Consumption: 82.12% Throughput:72.23% Lifetime: 80.26%

Table 1 Analysis of various Cluster Head (CH) selection and routing Techniques

Methods	Energy-consumption	Throughput	Lifetime
HAS-PSO	72.89	67.23	65.12
PSO-ECHS	80.89	77.23	73.12
SSMOECHS	63.29	81.23	77.12
DDRQR	62.89	83.23	80.12
NSOACO	72.89	80.23	76.12
FCEEC	86.00	32.28	66.32
CSP&AHP	85.34	85.14	78.24
E-LEACH	94.34	86.14	80.24
DC-KHO	88.34	87.14	83.24
IE2-LEACH	82.12	72.23	80.26

Table 2. Comparison of Energy & Throughput and Lifetime

V RESULT AND DISCUSSION

Table1 shows the analysis of various techniques based on Cluster Head(CH) selection and security of the routing. The various techniques have analysed based on various parameter such as contribution of proposed work, methodology, type of network, existing methods used their work and result. The performance of various techniques analysed based on various metrics such as energy consumption, throughput, and lifetime of network. Energy consumption means total energy consumed for transmission. Throughput is used to measure the number of packets received at destination per second. Lifetime of network is the measure of the time until the first sensor's energy runs out. Table 2 displays the comparison of different methods based on energy consumption, throughput, and lifetime of network. This work analysed various techniques such as HAS-PSO, PSO-ECHS, SSMOECHS, DDRQR, NSOACO, FCEEC, CSP&AHP, E-LEACH, DC-KHO and IE2-LEACH. Figure 1 shows the comparison of these methods. According to the analysis E-LEACH scored the high 94.34% of Energy consumption, DC_KHO scored 87.14 as highest throughput and DC_KHO scored 83.24% as highest lifetime.

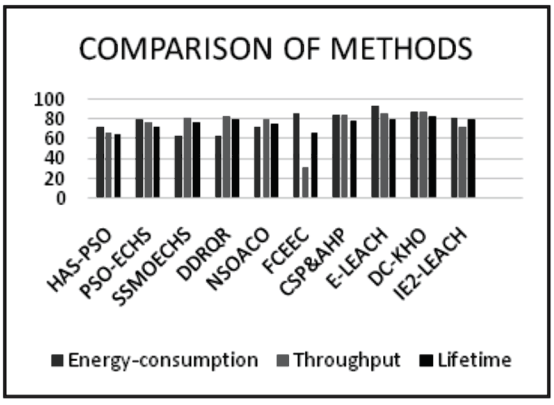

Figure 1. Analysis of Various Methods

VI CONCLUSION

This research article reviewed various WSN algorithms based on cluster head and routing techniques. The analysis based on various factors such as contribution of proposed

work, existing methods used in their work and results of their work. Based on analysis of different techniques, efficient cluster head selection will expand the lifetime of network, throughput and the rate of energy consumption. This work found that the E-LEACH gave better energy consumption, throughput and lifetime.

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