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Review Paper on Energy- Efficient Protocols in Wireless Sensor Networks

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Abstract: During latest times, wireless sensor networks with hundreds of sensor nodes have identified as significant systems for a broad range of efficiently manage varying from environmental to military applications. A sensor node is a static ad hoc network made up of hundreds of sensor nodes that could be implemented on the fly, so the primary design problem for a sensor network has to be the preservation of the energy available at every sensor node. WSN rely on systems with low energy, computational power, memory, as well as variety, so it is critical to improve energy efficiency by conserving battery power in order to extend the existence of the given WSN deployment. In this paper, several meta-heuristic methods are proposed to solve the energy conservation issue to high precision, as defined in terms of accuracy.

Keywords: Energy consumption, Wireless, Sensor network, routing protocols, energy efficient, network life time, sensor, battery, life.

I. INTRODUCTION

Wireless sensor network (WSN) (also known as a wireless sensor as well as actor network (WSAN) is a network of independent systems so as to detect physical or environmental conditions like temperature, sound, pressure, and so on. and to work together for sending their data from the network to a central location. Modern networks are bi - directional, that allows for regulation of sensor activity. Military applications like battlefield surveillance prompted the development of wireless sensor networks such networks are utilized in a wide range of industrial as well as consumer applications such as industrial process monitoring and control, machine health monitoring, etc.

The WSN is made up of "nodes," that can range from hundreds or even thousands, for each and every node linked to one (or every so often some) sensors.

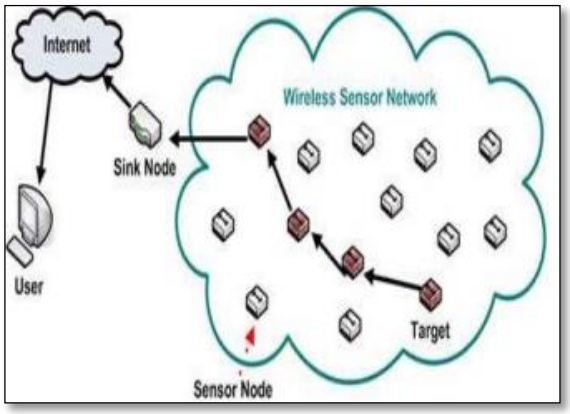

Fig. 1: Basic architecture of wireless sensor network[2]

This paper includes the following sections. Section II discusses about why energy efficient. Section III gives the meta-heuristic approaches in WSN. Section IV describes literature review. Section V represents the conclusion of the article.

II. WHY IT'S TO BE ENERGY EFFICIENT

The essentially significant limitation in or style challenge for wireless sensor networks are energy capacity. SN is normally power-driven by a battery, which should be substituted or regenerated once depleted. SN in wireless sensor networks typically use batteries to include power. These SN are typically implemented or installed within a geographical area to monitor the environment as well as gather information from it.

Once deployed, the SN is generally inaccessible to the operator. The most important consideration while using sensor nodes is that battery power must be immersed as little as possible in order to make the wireless sensor network energy cost-effective as well as energy efficient. When such kind of sensor nodes sends data or reviews to the sink or base station, they frequently consume battery energy, causing the network's energy consumption to rise. As a result, energy conservation as well as energy-efficient or economical routing protocols should be considered when developing the dynamic & adaptive networking concept for WSN [3]. By developing an energy-efficient or efficient routing protocol that reduces the energy utilization of information transmissions as well as extends network life is a key problem when generating an energy-efficient or efficient wireless sensor network.

Meta-heuristic methodologies are a significant class of solution techniques for practical optimization issues with high computational complexity in WSN. These systems are developed to offer near-best solutions to difficult optimization issues which will not solve accurately. Their

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benefits involve ease of installation, quick solutions, as well as resistance to variations in specific types [4].

III. META-HEURISTIC APPROACHES

Both old & new meta-heuristic approaches are still used in a variety of research fields. WSN had a number of these methodologies. As a result, this section provides background information on these methodologies.

A. Ant Colony Optimization (ACO): It is based on a bio-inspired methodology involved in real ant behavior. It has been noted that a group of ants could indeed work together to find the shortest path among their nest as well as their food. Pheromones are volatile chemical substances that ants use to communicate with one another [5].

B. Artificial Bee Colony (ABC): It is an important bio-inspired technique employed by honey bees' combined foraging actions [6]. It, like ACO, seeks optimal analytical methods by many large data sets. They could even fulfill their task to the social teamwork of 3 kinds of bees: employed bees, onlooker bees, and scout bees. The employed bees are in charge of looking for food that is available around the food source and sharing information with the onlooker bees, who then choose good quality food sources from those detected through the employed bees. ABC could even solve a multidimensional numerical issue [7].

C. Whale Optimization Algorithm (WOA): In recent years, an increasing number of modern meta-heuristic approaches have emerged. It is one of the most newly suggested meta-heuristic optimization problems, suggested 2016 by Mirjalili, S. as well as Lewis, A. WOA copy the natural hunting process of humpback whales. This method has been used in a variety of issues in many domains, such as WSNs, in a short period of time due to its ease of processing.

D. Grey Wolf Optimization (GWO): Mirjalili et al. suggested a new meta-heuristic named as Grey Wolf Optimizer (GWO) encouraged by grey wolves in [19]. It imitates the natural leadership hierarchy as well as hunting method of grey wolves [9].

E.GRAVITATIONAL SEARCH ALGORITHM (GSA)

The GSA is the most current population-based stochastic search approach inspired by nature, and it is broadly used to find an optimal solution. E. Rashedi [10] was the first to propose a gravitational search technique for solving optimization issues, particularly nonlinear difficulties. Newton's theory underpins the gravitational optimization algorithms. As per Newton's law of gravity, every atom draws another element through a few GF. The GF among 2 atoms is equal to the product of their masses as well as directly proportional to the distance of their separation .Every other atom in GSA has four requirements linked with it: particle role, inertial mass, active gravitational mass, as well as inactive gravitational mass. The solution will be implemented by the situation of the atoms, while the FF is utilized to measure the gravitational as well as IM. This scheme utilizes exploration ability at the outset to prevent local optimum problems, followed by exploitation.

IV. LITERATURE SURVEY

Kundu et al. (2020) introduced a multi optimization scheme based on the GSA for designing energy-efficient wireless sensor networks A QoS requirement is maintained in an energy management situation. It also took into account the development of effective cluster heads and the next hop for each CH. The SN is developed with the help of the GSA to meet all application-centric requirements while also being energy efficient. The development of uniformly sized clusters has been prioritized while the network's other properties have been preserved. Efficient management is incorporated to ensure maximum lifetime for WSNs without compromising network requirements. Super nodes are used to extend network lifetime while also maintaining network QoS requirements. The effect of super-node population on network lifetime is also approximated.

Alirezanejad et al. (2020) presented a GSA based on learning automata (GSA-LA) for constant problem optimization. The gravitational constant G(t) is a significant criterion which is used to change the search's correctness. Learning capability is used in this work to pick G(t) predicated on impulsive reactions. To review the effectiveness of the proposed technique, numerical analysis is performed on a number of well-made test functions, as well as the results are compared to the initial GSA as well as other evolutionary-based approaches. The simulation outcomes show that the gravitational search approach that is based upon learning automata is more helpful in identifying optimum solutions & outclasses the existing methods.

Song et al. (2020) On the on-chip embedded debugging scheme, the variable detection of a wireless sensor network premised on the Leach protocol was investigated. As its traditional LEACH suffers from energy imbalance as well as a short node life cycle, with the utilization of embedded debugging technique this article focused on the LEACH algorithm, as well as the remaining energy & position of nodes were investigated in wireless sensor networks. The wheel concept is used in this LEACH algorithm. Every round is divided into two stages: initialization as well as stabilization. Every other node selects a new number among 0 and 1 during the initialization stage. If a node's random number is in a smaller amount than the set threshold T (n), the node publishes a message indicating that it is the CH.

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Abu Salem and Shudifat (2019) To resolve network lifetime as well as energy constraints, the LEACH (low energy adaptive clustering hierarchy) procedure was improved. LEACH has been enlarged by recognizing a cluster head which is based on the shortest degree of separation different from the base station in way to reduce power utilization in CH nodes as well as throughout the network. The findings demonstrate that power consumption is reduced, & thus the life span of a network is greater than before. With the number of repetitions increased, the power consumption decreases yet further.

Zeng et al. (2019) the recommended Energy-Coverage Ratio Clustering Protocol (ECRCP) is focused on lowering the system's energy consumption as well as accessing the regional coverage ratio. Firstly, an energy model is formed. The efficient quantity of clusters is defined by the principle of "minimum energy consumption" & The CH selection is founded on the principle of "regional coverage maximization". With respect to manage the network load as soon as possible, the cluster head with the lowest residual energy or the largest energy consumption is modified in the next iteration of cluster head selection to extend the network's life. Simulated outcomes show that the suggested approach having some benefits with respect to network life, load balancing, as well as overall energy consumption in a heterogeneous energy wireless sensor network environment.

Mohapatra and Rath (2019) suggested a LEACH variant clustering convention known as the partitioned-based energy-efficient – LEACH (PE-LEACH) procedure, that is predicated on an energy-based fault-tolerant method. PE-LEACH is compared to its predecessors, which include hard-computing-based LEACH, energy-efficient LEACH (E-LEACH) convention, as well as soft-computing-based energy-swarm-optimization LEACH (ESO-LEACH). They discovered that PE-LEACH outclasses LEACH as well as E-LEACH individually, whereas ESO-LEACH faces stiff competition from PE-LEACH.

Tomar and Shukla (2019) In NS2 presented an energy-efficient GSA and Fuzzy clustering with Hop count based routing (GSA-FCR). CHs are chosen from the network's accessible sensor nodes using the GSA method. Then, every selected CH produced a cluster through connecting to other sensor nodes within its transmission range. By using Fuzzy Inference System, the super cluster head was chosen from among the chosen CHs. The data collected from the non-CH member was then relayed by the CH via the most efficient route to the chosen SCH. The hop-count of the CHs was used to determine the most efficient route. The suggested GSA-performance FCR's has been assessed in terms of energy effectiveness, delivery ratio, delay, drop, as well as throughput, and this also compared to current systems like GECR and PSOCR. The simulation shows that suggested method's energy efficiency as well as delivery ratio was better to that of the existing work.

Aziz et al. (2018) Pure GSA for WSN was evaluated utilizing sparse network, one optimal amount of sensors, and three dense networks. In GSA, pure GSA resolved the Newton law of gravity aspect. It uses a higher G0 value unlike GSA to avoid premature convergence. The use of Pure GSA in the WSN coverage maximization issue demonstrates that Pure GSA can outshine GSA as well as obtain greater coverage.

V. CONCLUSION

Energy efficiency is a main complex task in the layout of routing protocols for WSNs. The sensors' energy consumption is controlled by data transmission and reception. This paper concludes that WSN is an effective way to determine energy conservation, so it proposed a new procedure for measuring region and resolving energy distribution. The primary goal is to demonstrate that using clusters in a WSN via meta-heuristic approaches is more efficient for predicting energy efficiency and communication range.

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