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# Routing Protocol using in WSN Performance: A Review

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**ABSTRACT:** - The number of devices linked to the Internet will have increased rapidly, effortlessly transitioning the Internet from a network of people to a network of things. These devices may interact and exchange data with one another, establishing a large Wireless Sensor Network (WSN). WSNs are mostly made up of a huge number of tiny devices that run on batteries, limiting the amount of energy available. As a result, for WSNs that are scalable and resilient in terms of energy consumption and longevity, it is critical to employ an energy efficient routing technique. The data communication system in sensor network depends on connection establishment and maintenance of connection between sensor nodes. The networking technique should function as usual as number of nodes increases. Energy concerns can be solved by using routing protocols based on clustering. Clustering strategies are among the most broadly suggested approaches by the scientific community for maintaining a sensor network over time while still ensuring a flexible infrastructure and effective data distribution. This paper studied of different research paper and find best routing protocol.

**KEYWORDS:-** Wireless Sensor Network, Cluster Head, Routing Protocol

## I. INTRODUCTION

Recently the advancement of wireless sensor networks (WSNs) has opened up a whole new fascinating field for the implementation of new technologies in deployment of WSNs. By the next decade, the WSN is expected to be linking billions of devices, where devices interact with each other without human interference. Contact between devices is unique to the application and the wireless sensor network provides the internet with a backbone for application results [1]. WSNs are an excellent option for a broad variety of applications, since they can sense the world, contact neighbouring nodes and perform simple calculations on the collected data in various circumstances. Initially wireless sensor networks were used for military surveillance but later the applications were extended to other fields such as industrial manufacturing, health monitoring, ecosystem monitoring, and environmental monitoring. Another few applications enabled by WSNs include agricultural and vegetation monitoring, remote sensing, weather prediction, volcanic activity surveillance, military surveillance, traffic state updates, and biological monitoring systems. Geoinformatics (GIS) and smart transportation system (ITS) are quite distinct categorized uses of WSN [2]. The network market for wireless sensors was projected at US\$ 46.76 billion in 2019 and is expected to hit US\$ 123.93 billion by the year 2025, with a CAGR (annual growth rate) of around 17.64 percent within the estimate period of 2020-2025 (Fig. 1) [3].

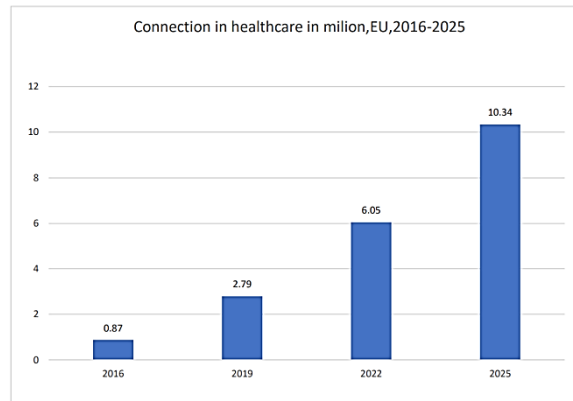


Fig. 1: WSN Scope

**1.1 WSN Architecture**

A WSN network comprises of autonomous sensors that are spatially distributed, positioned in the environment to track information and then transfer the information for further processing to a special node called a sink or base station. Every network node has components: a trans-receiver for sending and receiving a signal, a microcontroller for processing information, sensors for sensing specific parameters and a small power battery. The sensor nodes come in various size ranges and may be of the size of the dust grain or the size of a display box. The architecture of the network typically varies from a basic star to a sophisticated wireless mesh network. The sensor node often varies from the series of images shown at a certain frequency rate (frames per second) that is referred to as a video sequence [4]. The sensor gathers the real world's analog data and an ADC transmutes the gathered data to digital data. Typically, the primary processing is performed by a microprocessor or micro-controller unit, for the smart data processing and transmission. The WSNs communications system are composed of radio transceiver systems, where the radio module is generally a short-range radio, for transmitting and receiving data as seen in fig. 2 [5, 6]. A sensor node is directly related to the network analysis, data management and processing, data collection and correlation of data from another nearby sensor with its own data with all of these features and components. The sensor node could be static or mobile. The position of node in the region can be taken by position system whereas mobility system can provide mobility to the node or base station.

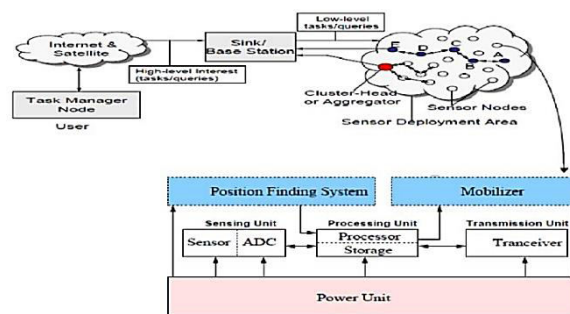


Fig. 2: WSN Architecture

While a robust sensor network tolerated node failure and loud sensor readings is defined, sensor nodes may waste precious battery resources to send duplicate data. In order to forecast the energy consumption of different methodologies, architectural topologies and creating energy efficient methods, a precise knowledge of the amount of power used at a particular sensor node is essential.

**II. ROUTING ALGORITHM**

Considering various issues and challenges of routing in sensor communications, various novel algorithms/protocols are proposed to for efficient routing in sensor networks. Fig. 3 demonstrates the types of routing algorithms. Routing algorithms can be classified into following two major categories:



**Nonadaptive Routing Algorithms:**-Nonadaptive routing algorithms don't take routing decision on basis of measurements and estimates of current traffic and topology.

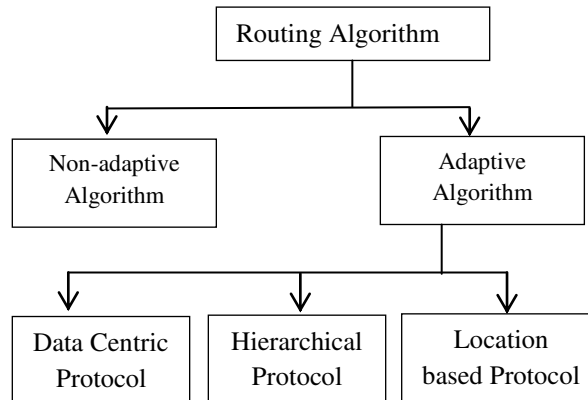


Fig. 3: Classifications of Routing Algorithms

The routing path from node to node is determined in advanced, off-line and downloaded to routers when booting of network is performed. Non-adaptive routing is also known as static routing. In terms of static routing, any change in topology or loss of link, the node is not compensated, which means either packet transmission would be halted or repaired or restarted.

**Adaptive Routing Algorithms:**-Most of wireless communication networks makes use of Adaptive routing algorithms. The Adaptive routing algorithms (Dynamic Routing Algorithms) change their respective routing decision with regard to any sort of change in network topology and traffic load. Adaptive routing mainly defines the ability of the system, in calculating the optimized routes from source to destination and to modify the path the route takes through the system with regard to changing conditions. Adaptive routing is basically designed to allow as many as routes as possible to cope up with packet loss, in response to any sort of change in the network. Adaptive routing is utilized in networking to describe the ability of network to make changes in route discovery, path establishment and data transfer between nodes.

### III. LITERATURE REVIEW

**Jian Xu et al. [1]**, AODV is a lightweight routing protocol for ad hoc networks, but there are some faults such as not considering the energy consumption of nodes and frequent flooding when it is used in WSN. In order to make up for its shortcomings, an modified AODV protocol is designed by introducing the idea of ant colony algorithm. It provides multiple optional routes, reduces the flooding probability, and can protect low-power nodes, which is more suitable for WSN networks. Simulation results show that the modified AODV protocol reduces the energy consumption of nodes, prolongs the life of nodes, and effectively improves the stability and communication efficiency of the network.

**G. Ramya et al. [2]**, WSN is a group of compact, low-energy nodes that have become an integral component of modern connectivity networks and are very important in industry and academia. Energy is critical in WSN, and the architecture of WSN is focused on energy conservation in the research group and node power usage presents a big challenge for improving the existence of WSN. Because of the challenging climate it can be expensive or perhaps hard to charge or repair consumed batteries. In this report, various strategies of energy management are implemented to decrease energy usage, boost network capacity and maximise network life.

**Dheyab Salma et al. [3]**, this paper studies clustering load balance and routing protocol in Wireless Sensor Networks (WSNs). After improve RDCA clustering algorithm, we present a Two-Layered Clustering-Based MultiHop Routing Protocol (TLCBMH). Unlike RDCA, TLCBMH uses two different communication radiuses, low radius and high radius. Low radius is the cluster radius. High radius is the transmission power radius which cluster heads use to search for spare cluster heads. High radius is double of low radius. That fits more application environment of WSNs. After the clustering, cluster heads in RDCA communicate direct with the base station. The cluster heads in TLCBMH access to



the base station through multihop. It deals with failed nodes at the initialization period of every work round, which makes WSNs more robust. Compared with RDCA, network simulation proves TLCBMH does not lose any clustering ability. However, it promotes WSNs average lifetime.

**ArifaNafeh Ali et al. [4]**, WSNs is one of the most important types of networks in the world where sensors collect information within a specific area and send the data to a central point called the Base Station (BS). Many researchers have attempted to develop or improve the performance of WSNs by trying to mitigate the limitations and challenges facing WSNs. The most important challenge is to reduce energy consumption in a limited battery power supply of sensor nodes. Various energy-saving routing protocols have been proposed to solve this problem to maintain the lifetime of the network for longer periods. In this paper, we propose a Heterogeneous DSR PEGASIS Optimization Routing Protocol (HDPORP) in which we combined the desirable features of both DSR and PEGASIS protocols. Through our simulation, we used Dijkstra's algorithm to find the shortest path between each node to Cluster Head and finally, we used an energy list that keeps track of nodes energy to update the network with high energy nodes and exclude low energy nodes. The simulation results showed that the HDPORP protocol extends the lifetime of the WSN compared to other protocols by 10 %.

**Xingjin Wang et al. [5]**, WSNs have been progressively intrigued by industry and scholarly cycles for their expected use in applications like natural observing also, military reconnaissance, etc. The paper thinks about the energy requirements of bunched WSNs and proposes an improved directing convention for such WSNs to accomplish a worldwide streamlining in energy utilization for all group head hubs, which diminish the impacts of problem areas in certain hubs close to the sink hub and forestall the hot head hubs to be over-burden for information correspondence. In such a steering convention, a period arranged rivalry calculation is utilized to choose bunch head hubs for a running WSN to lessen the unique geography of transmission message among sensor hubs rather than arrangement instrument, which is pointed toward lessening network traffic troubles. Besides the distance among hubs and the sink hub as a crusade record are considered to decrease the inconsistent power circulation of bunches' hubs in WSNs oversee by the conventions, which help to uniform devouring energy, all things considered, in a WSN somewhat. The hubs in a group choose their head hub by considering the distance between their correspondence position and up-and-comer group head hubs, for which the proposed convention ensures a sane size of the bunch.

**NashreenNesa et al. [6]**, energy conservation is a challenging concern with the growing advancement in Internet of Things (IoT) technologies and is currently one of the attractive issues among researchers working in the IoT domain. In this paper, they address this issue by devising a dynamic sensor activation algorithm inspired by the popular PageRank algorithm called Sensor Rank. Unlike PageRank algorithm which only requires the outlinks to rank webpages, SensorRank, on the other hand, dynamically analyses the network topology in terms of relative distances and link qualities between devices and the remaining energies of the devices, based on which the sensors are ranked. Optimal subsets of sensors are activated that take part in data fusion and the inactivated sensor data are regenerated with the help of Compressing Sensing technique.

**Xiuwen Fu et al. [7]**, in these routing protocols the routing survivability under harsh environments is questionable. To tackle this issue, in this paper by referencing the concept of potential field, they design an environment-cognitive multipath routing protocol (ECMRP) in order to provide sustainable message forwarding service under harsh environments. In ECMRP, routing decisions are made according to a mixed potential field in terms of depth, residual energy and environment. The basic idea of this approach is to instruct data packets to select routes with the tradeoff among latency, energy conservation and routing survivability. As the environmental field is constructed and updated using the sensing capability of WSN itself, constructed routes can avoid crossing through the danger zones to keep the paths safe. The experimental results show that ECMRP can obtain significant improvements in packet delivery ratio and network lifetime under harsh conditions.

**Da-Ren Chen et al. [8]**, to effectively save energy and prolong network lifetimes, networks typically adopt clustering protocols with hierarchical inter-cluster topologies for network management and data acquisition in WSNs. However, such solutions require cluster re-configuration due to early death of cluster heads (CHs) and energy inefficiency. This paper proposes a coverage- and energy-aware protocol with intra- and inter-cluster methods called CEMST based on newly defined parameters for sensor overlapping and node density functions. In addition, to adapt network dynamics



while improving energy efficiency, a self-stabilizing algorithm is proposed with the Boruvka algorithm to respectively construct minimum spanning trees (MST) for intra- and inter-cluster routes.

#### IV. PROBLEM FORMULATION

The major concern while designing and planning WSNs operation is energy consumption. Therefore, it is important to be aware regarding the residual energy and configuration of power consumed by different components of SNs. It is equally important to study the efficient algorithms that assist the organization and operation of WSN effectively.

The main objective of this research work is to design and develop communication protocols for energy constrained networks to achieve energy efficiency while maintaining good energy-delay tradeoffs. The focus is on WSNs as a class of energy constrained networks which are generally static, have little or no mobility, and have limited battery supplies. Ideally, these protocols should prolong network lifetime, without overly compromising on other performance metrics that are of interest to the application. In this dissertation, novel energy efficient communication protocols are presented that not only address the limitations of existing protocols, but also achieve good tradeoffs for energy constrained networks.

#### V. METHODOLOGY

Mechanism of fuzzy decision making involves manipulation of fuzzy variable through linguistic equations or fuzzy rules. The below Figure 4 explains the whole mechanism.

Fuzzification: In fuzzification, membership degree is computed for each input variable with respect to its linguistic term.

Rule matching: In rule matching, the firing strength (degree of satisfaction) of individual rule is calculated.

Fuzzy Inference: The recommendation of rules according to firing strengths and rule conclusions are determined in fuzzy inference.

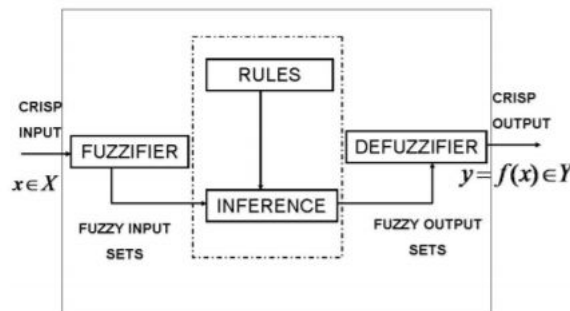


Fig. 4: The structure of a fuzzy logic system

Fuzzy Aggregation: Fuzzy aggregation combines recommendations from individual rules into an overall implied fuzzy set.

Defuzzification: Defuzzification involves determination of a crisp value based on implied fuzzy sets derived from the rules, as final result or solution.

Considering E as the set of energy of all the N nodes, K is the expected number of clusters and X and Y are the set of locations of various nodes in the Wireless Sensor Network the algorithm for cluster head selection in EELEACH-C works as follows:

Algorithm CH-Selection (E, N, K, X, Y)

1. Asc - sort(E)
2. i = 1
3. **while**  $i \leq N$  **do**
4. **if**  $(E_i \geq E_{Avg}$  and  $i \leq k)$  **then**
5. Eligible(i) = True
6. **else**
7. Eligible(i) = False
8. **end if**



9.  $i = i + 1$
10. **end while**
11. **if**( $dist_i > dist_j$  and Eligible (i)) **then**
12.  $CH_i = CM_j$
13. **end if**
14. **return**( $CH_i, CH_j$ )

Here, we explain in detail our new energy efficient EELACH-C protocol whose goal is to increase the longevity of the network. Let us assume that all the sensor nodes are equipped with equal amount of initial energy.

## VI. CONCLUSION

The Internet of Things is supposed to bind billions of devices, where devices without human intervention communicate with each other. Communication between users is unique to the application and the network of wireless sensors provides the internet with a backbone for the results of the application. The key developments have been major investments in the industry to build new sensor technology and to update existing infrastructure to enable IoT and automation, affecting the industry on a worldwide scale. The WSN's goal is to track one or more of the characteristics of a region known as the 'Area of Interest' or the 'Area of Sensing'. In the Morden network structure, the sensing activity is mainly governed by sinks. A trans-receiver for transmitting and receiving a signal, a microcontroller for processing information, sensors for sensing particular parameters and a small power battery are components of any network node. All the sensor nodes are fixed without rotation in many applications and these are static networks.

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