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"A SURVEY ON ROUTING TECHNIQUES IN WIRELESS SENSOR NETWORKS"

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ABSTRACT

The term "wireless sensor network," or WSN, refers to a technology that has recently become a useful addition to modern wireless communication networks. Wireless sensor networks can last longer by using less energy, which is made possible by choosing the best data transfer paths. Wireless sensor networks (WSNs) have their own protocols for sharing data, managing power, and finding the best route. Energy awareness is a key part of the architecture of WSNs. Since there isn't yet a standard communication stack for WSNs, the routing protocols could be different depending on the application and the architecture of the network. Routing protocols that are more up-to-date are needed to make ubiquitous and pervasive computing work. In this article, Wireless Sensor Network Routing Protocols are separated into four groups: the creation of routing paths, the structure of the network, how the protocol works, and who starts the conversation. Also, routing protocols have been put into groups based on how similar or different the sensor nodes they connect are, as well as whether they are clustered or not within either of these two groups. Some of the new features that have been added to these routing protocols are the ability to combine data, the ability to ask questions, and the ability for the network to grow.

Key Words: *Sensor Networks, WSN, Wireless Communication.*

I. INTRODUCTION

When we talk about Wireless Sensor Networks, we're referring to a network of geographically scattered tiny devices known as sensor nodes or motes that collaborate to wirelessly share data from a visible field. The information accumulated by the diverse motes will be sent to a sink node which either utilizes the information locally or by sending them to remote location using different networks through internet (Priyanka Rawat *et al. 2014*)

Various methods are used for deploying sensor nodes. Based on the area, deployment is done either indoor mechanism or outdoor mechanism. Indoor deployment is implemented within a closed circle, for example with in a building. Outdoor deployment is implemented for wide range of area which is not closed. Based on the placement of nodes, there are two different strategies followed in the sensor network. They are unplanned and planned deployment. The unplanned deployment is implemented by placing sensor nodes on the large- scale region. For example, nodes are dropped through air by helicopter with the help of parachute and additional devices to change the dropping behavior. Another example is centrifugal sprinkler which is used for spraying required water uniformly in the region of a candidate. For emergency situation like forest fire these methods prove to be effective. This also called as random scheme. Planned deployment is implemented by placing the nodes carefully on the particular places with regular interval between nodes. It will be useful only for small area. The other name of the planned deployment is deterministic deployment sometimes, the sensor nodes have to move from place to place to reach the destination. For example, the sensor nodes placed in vehicles need to move their positions wherever the vehicle moves. Based on the movement of the senor node, there are two classifications. One is called virtual force method. It uses law of movement related to physics. Another is called pre-computed method. The direction and place of movement of sensor nodes are done based on the previously computed place. Sometimes, combination of both the methods will be used.

Based on the utilization, three methods will be used. First one is called bedspread method. It will be used only for a particular area where the person is available. For example, if a VIP attends any function, then dais will be covered with sensors of bedspread to identify any suspicious activities. Second one is stumbling block scheme which is used to deploy sensor nodes in the complete area of a place where the function is organized. For example, if the Prime minister attends a function, then protection is extended to the entire area including the dais. It is like fencing the complete area. Third one is target object. This scheme is useful when we need to enter into the enemy campus.

Potential area-based scheme considers locating a person inside natural obstacles such as buildings, ponds etc. It is suitable for nodes which have a capability to move. These nodes are deployed in a small area and it will maximize its coverage by moving and placing the nodes uniformly.

Combination of random scheme and moving capability of sensor nodes uses many deployment schemes. They are virtual stress-based scheme, connectivity conserved virtual stress scheme, scheme based on FLOOR, Press-Release based scheme, distributed exploitation Method, SEEDS: Scalable power Efficient Exploitation Scheme, distributed self-scattering scheme, error revoking and identical, scheme based on Vector, Voroni, Minimax scheme, centroid movement schemes, scan movement schemes, glowworm swarm optimization method (Vikrant Sharma *et al. 2016*).

Based on the coverage, there are two classifications such as area exposure and location exposure. The entire area marked for sensing should be enclosed by some sensor motes in the area of exposure. In location exposure, some sensor motes should be attached to places wherever the application needs.

II. RELATED WORK

According to industry analysts, wireless communication networks will play a significant role in the future. Recent advancements in wireless communication and low-power technologies have given rise to Industrial Wireless Sensor Networks (IWSNs), which provide a number of benefits, including ease of installation. Factory automation, industrial process monitoring, and plant monitoring are all examples of IWSN applications. Traditional routing protocols such as AODV (Perkins et al., 1999), AOMDV (Marina et al., 2001), and DSR may not be suitable for usage in industrial settings due to extreme situations, interference concerns, and other constraints (Johnson et al. 1996). The entire wireless sensor network is powered by a single battery. Sensor nodes communicate with other nodes in the network using single-hop or multi-hop communication.

Aishwarya Karmarkar (2020) et.al Wireless Sensor Networks have recently been used to solve a broad range of real-world concerns, including environmental monitoring, home automation, and medical monitoring. Small sensor nodes in these systems are prone to failure due to hardware and software issues, as well as excessive energy consumption. Faulty sensor nodes may provide incorrect data, reducing WSN performance. Finding and diagnosing problems is a major issue with WSNs. A Support-Vector Machine enhanced in this study provides wireless sensor network defect assessment (SVM). To detect sensor node failures and inform the user, the suggested technique employs a Grey Wolf Optimization (GWO)-based SVM classifier. It has also been recommended that a cluster-based architecture, which consumes less energy, be used. Using a large number of computer simulations, the suggested fault detection approach was tested in a range of network topologies. The performance of the proposed fault detection approach is confirmed by comparing simulation results to those of current systems.

Rakesh Ranjan Swain (2017) et.al A particle swarm optimization (PSO) approach was used to create a real-time soft fault detection model for wireless sensor networks (WSNs). The three phases of the diagnostic process that the suggested technique isolates in order to discover sensor network composite defects are initialization, fault detection, and fault categorization (combined problems of soft permanent, intermittent, and transitory nature). An study of variance may assist you in locating the network's troublesome nodes (ANOVA). The feed forward neural network (FFNN) and the PSO learning algorithm are used to classify defective nodes. In a controlled indoor environment, we will put our theory to the test.

Li Liu (2020) et.al Border tracking is an essential issue for industrial wireless sensor networks when working with continuous products (such as gaseous chemical compounds, oil spills, and radioactive waste) (IWSNs). To build an

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IWSN continuous object boundary tracking method, we employ sensor node collective intelligence and machine learning capabilities. The method recommends beginning with an upper limit on the event zone covered by continuous objects. The coarse-grained border areas can be mapped using a complete binary tree-based split of the event region. To learn more about the irregularities of continuous objects, a binary classification problem is utilized. To address the binary classification problem, a hierarchical soft margin support vector machine training technique is utilized. According to the simulation results, employing the proposed technique, good tracking accuracy may be achieved with fewer border nodes. Because of the fault-tolerant algorithms, the suggested solution is resistant to erroneous sensor readings when used in industrial settings, even if a small number of nodes fail.

Pialy Biswas (2019) et.al Data aggregation, fusion, and collecting techniques are rapidly being used in wireless sensor networks (WSN). The sensor node receives data and sends it to the final node for analysis and storage as part of a WSN network. WSN's utility is limited by issues such as low-cost sensor nodes and insufficient battery backups. Due to resource constraints, flaws in WSN sensor nodes can be easily exploited. Predictive detection using data fusion may be a great option for locating the issue more efficiently. Because of the sensor node's limited storage and processing capacity, an Extreme learning machine/Kalman filter hybrid predictive classification technique is developed. Instead of utilizing more data, the Kalman filter trains the sink node with the erroneous data pattern. An Extreme Learning Machine (ELM) is a predictive classifier that can make accurate predictions with low communication overhead. In the proposed study, random anomalies are injected into standard WSN data to examine how they impact the outcomes. Performance is measured by factors such as detection accuracy and computation time.

Sachin Dhanoriya (2017) et.al Recent advancements in sensor nodes and sensor networks have had a tremendous influence on the society we live in today. Sensor nodes and sensor networks will become increasingly important in sectors such as research, health, and the military as our daily lives become more automated. As sensor nodes and sensor networks develop, a rising number of anomalies and errors are associated with them. These discrepancies jeopardize the consistency and dependability of sensor networks. This review article for sensor nodes examines many fault-tolerant methods for sensor nodes and networks that deal with failures, bridges, and radiation effects.

III. ROUTING TECHNIQUES IN WSN

Routing protocols can be put into one of four groups based on how routing paths are made, the structure of the network, how the protocol works, and who makes the first contact. Figure 1 shows the different types of WSN routing protocols.

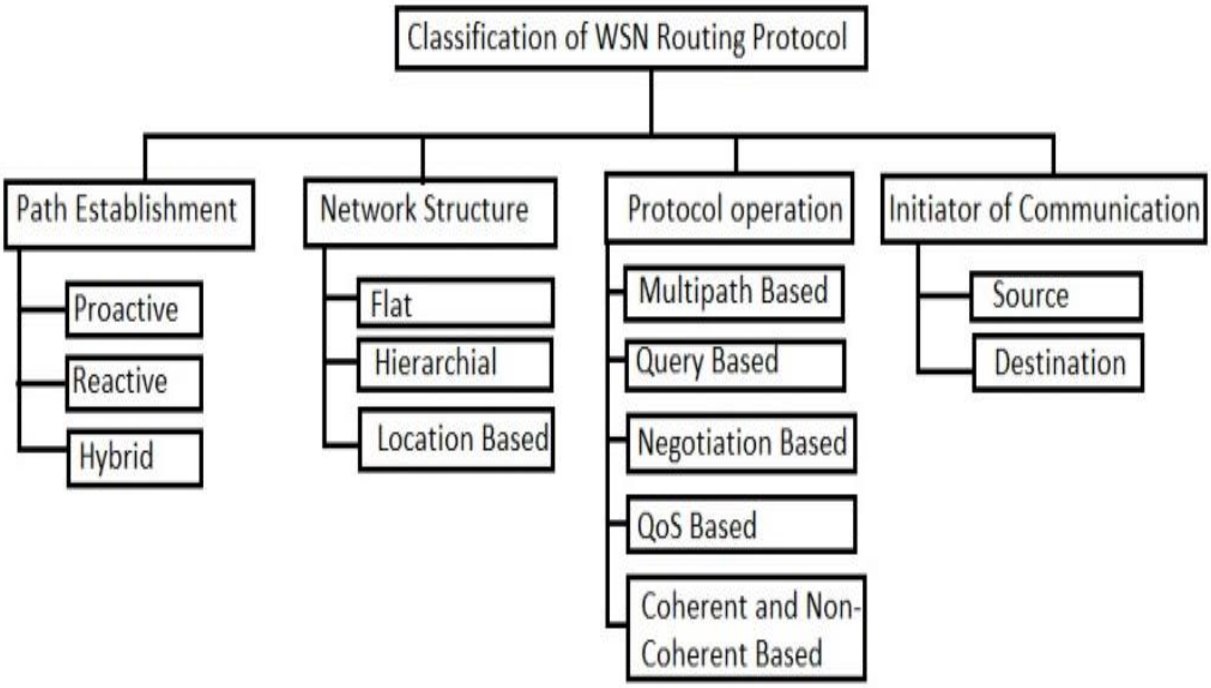

Fig.1: Classification of Routing Protocols in Wireless Sensor Network.

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There are three ways to set up routing patterns: proactively, reactively, or through a mix of the two. A proactive protocol is one that figures out all the routes long before they are needed and stores the results of that calculation in a routing table on each node. When there is a change in the route, that change needs to be sent out to the entire network. Wireless sensor networks (WSNs) can have thousands of nodes, which means that the routing table that each node needs to keep could be very large. This means that proactive protocols are not an option for WSNs. Reactive protocols only figure out routes when they are really needed. Hybrid procedures take ideas from both of these schools of thought and use them together.

The network flow model can be used to tell the difference between three types of routing systems: flat routing, hierarchical-based routing, and location-based routing. Every node in a flat-based routing scheme does the same thing. Hierarchical routing, on the other hand, lets different nodes in the network take on different tasks. In location-based routing, the positions of the sensor nodes are used to figure out the path that data will take across the network.

Flat Routing (Data Centric Routing protocols) : It Due to the large number of nodes that are used in many sensor network applications, it is not possible to give each and every node in the network a global identifier. Because of this lack of global identification and the fact that sensor nodes are put in place at random, it is hard to figure out which sensor nodes should be queried. Because of this, most of the time, each sensor node in the deployment area sends data with a lot of redundancy. Since this was a problem, data-centric routing was made. In a data-centric routing system, the sink will send questions to certain regions and then wait for responses from the sensors in those regions.

Hierarchical protocols : One of the most important things to think about when designing sensor networks is how well they can grow. Because sensors can't talk to each other over long distances, the architecture of a single gateway can't be changed to fit more sensors. In different routing systems, networking clustering has been tried so that more load can be handled and a large area of interest can be covered without the service getting worse. In the first step of hierarchical routing, the cluster heads are chosen, and in the second step, the routing is done. To make the WSN use less energy, clusters are being made and different tasks, such as data aggregation and fusion, are being given to different groups. As a result, the system as a whole is better able to grow, last longer, and use less energy.

Location-based protocols: Most of the time, you need to know the location of two nodes in order to figure out how far apart they are and estimate how much energy they are using. Most of the time, there are two ways to figure out where you are. The first is to figure out the coordinates of a nearby node, and the second is to use GPS (Global Positioning System). Because sensor networks like IPaddresses don't have a way to address them and are spread out across a territory, location information can be used to route data efficiently and in a way that is good for the environment.

IV. CONCLUSION

Routing methods in WSNs are still being studied, even though sensor nodes are being used in more and more useful ways. As the fields of pervasive and ubiquitous computing and Nano technology grow, they are beginning to overlap, which has led to new routing problems. This study sorts routing protocols into groups based on whether the deployed sensor nodes are all the same or all different. Researchers can now study these algorithms in ways that haven't been done before. We also gave a high-level overview of the different routing protocols that are available, focusing on those that are best at aggregating data, supporting queries, and making networks bigger.

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