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Wireless Network Routing protocol algorithms: A Technical Review

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Abstract: Many new protocols have been developed especially for sensor networks where energy awareness is a crucial factor as a result of recent advancements in wireless sensor networks. Nonetheless, because routing protocols can vary based on the application and network architecture, they have received the majority of attention.This paper provides a thorough review of the literature on the most recent developments in wireless networks of various routing protocols techniques that can be used for Mobile Ad Hoc Networks. To enable data communication in wireless ad hoc networks, numerous routing protocols have been created, and a great number of excellent research articles have published that thoroughly address the routing problem. These routing protocols, despite their shown efficacy, were created in secure environments with no security considerations.This paper presents a brief survey on routing protocols based on fault-tolerant, location, multi-path methods are discussed. Comparing to these algorithms the Load-balanced multi-path routing protocol and Fault-tolerant ad hoc on-demand routing protocolalgorithms outperforms having better performance than other methods.

Keywords: MANET, Routing Protocols, Ad Hoc Networks, Energy, Path Selection.

1. Introduction

One particular kind of wireless ad hoc network with distinctive characteristics is the wireless sensor network (WSN) [1], [2]. These are often made up of a number of wireless devices, or nodes, with sensing, computing, and communication capabilities that work together to build networks that are responsible for relaying data to the sinks, usually hop-by-hop. Though they have a variety of uses [3], they are often placed in certain locations to keep an eye on particular activities. Some of these scenarios involve the nodes in the detected region becoming active and transmitting data towards the sink or sinks, which collect all of the network's data, while others, depending on the application, involve them reporting to the sink on a regular basis in response to an event.

A group of mobile nodes that comprise an ad hoc network function without the centralized management or regular support components seen in conventional networks [4-6]. As a result, it can be said that an ad hoc network is a group of wireless mobile nodes that come together to establish a temporary network without the use of any network infrastructure. As scalable topologies, they may hence be installed with ease. Mobile Ad-hoc Networks (MANETs) are networks of wirelessly connected mobile nodes and routers that can self-configure. As a host and a router, a mobile node in a MANET serves two purposes. As its own router, each MANET node sends packets to its peer nodes. This survey aims to present a thorough analysis of various Routing Protocol for Mobile Ad Hoc Network methods used in wireless networks [7-9].In a data communication network, messages must be forwarded by intermediary nodes in order for two or more nodes that are not directly connected by a communication link to receive or send messages to one another. In data communication networks, the process of acquiring a route to convey messages between two nodes is known as the routing process' route acquisition [10-13]. In a conventional network, the nodes tasked with routing are known as routers. Packet switching, packet filtering, internetwork communication, and path selection are among the router functions in a network.The selection of routes for different source-destination pairings and the delivery of messages to the intended recipient are the two primary tasks of the routing protocol.

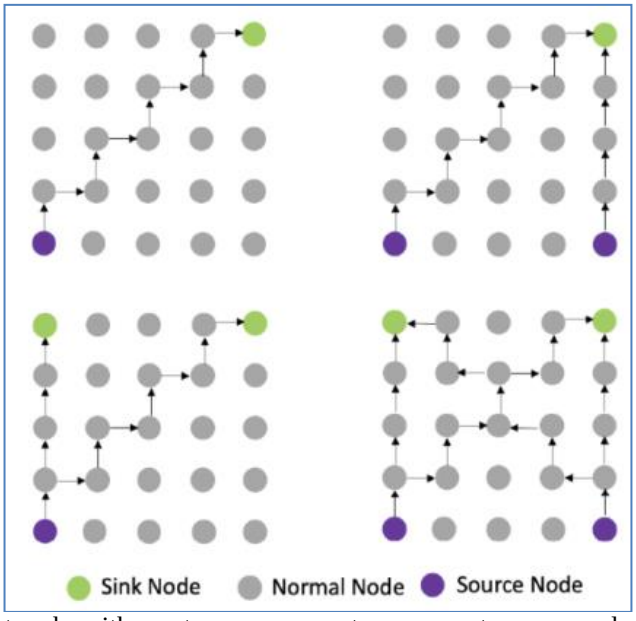

Fig.1: Wireless sensor networks with one-to-many, many-to-one, one-to-many, and many-to-many examples.

Research on WSNs with multiple sources that must deliver data to a single sink (also known as many-to-one) is well-explored. This research often assumes that numerous sensing nodes report data to a single base station for additional data processing [14], [15] and [16]. One-to-many are some applications, for instance, where numerous actuators must react to the same environmental change detected by a single source, despite the fact that many networks are less prevalent and thus fewer routing protocols have been created for this case [17-20]. Figure 1 shows example topologies of wireless sensor networks with one-to-many, many-to-one, and one-to-one connections.
The rest of the paper is organized as follows: wireless network routing protocols techniques are discussed in literature Review is detailed in Sect. 2. The conclusion and future work is in Sect. 4.

2. Related Work

This part includes some of recent research on the exploit of Wireless network routing techniques.
A way to use NDN for communication in the particular setting of disaster aid was suggested by Jin et al. [21]. First of all, they suggested a proactive routing system that also supports reactive routing. In order to update its own FIB, each node synchronizes the Network Information Base and broadcasts its existence to nearby peers. To investigate possible pathways, a universal entry set in FIB can be utilized. To allow multipath forwarding, there are still numerous next-hops for each prefix in FIB. Second, it can use multipath to increase transmission efficiency or reliability by copying or dividing the queue of Interests at a node.
According to Robinson et al. [22], mobile ad hoc networks, or MANETs, are important in the communication industry. The network infrastructure is always changing as a result of the nodes' dynamic movement. Every node is capable of self-configuration and communication via multi-hop routing or straight through a few intermediate nodes depending on the strength of the signal. Nevertheless, choosing the intermediate nodes during the route discovery process will result in more routing overload. In order to broadcast data packets with connection scalability, destination nodes are chosen utilizing intermediary nodes. Previous approaches to this problem had disadvantages, such as limited packet delivery possibilities and inflexibility in providing Quality of Service within the network paradigm. The path discovery phase is expedited with less time according to the authors' suggested Fault-Tolerant Disjoint Multipath Distance Vector Routing Algorithm (FD-AOMDV). In this method, routing overloads are significantly reduced when disconnected paths are found. By lowering the routing overload upon establishment of the most recent route, FD-AOMDV can improve scalability. Furthermore, because nodes in MANETs are mobile, each time a link is broken, the active path would disconnect, increasing the routing overload.

To improve the performance of the Internet of Things applications, Solapure and Kenchannavar [23] suggested OFs designs utilizing a range of routing parameters. The examination of multiple situations for these architectures reveals that the requirements of smart applications cannot be addressed by relying just on standard hop and Expected Transmission Count (ETX) routing characteristics. The main concept of the suggested architecture is the routing metric selection based on the application requirements. To improve the design of the RPL's goal function for Internet of Things applications, three metrics are used: ETX, Content, and Energy, both separately and in combination. These designs incorporate the improved triggering technique to further increase RPL. The cumulative impact of the default trickle timer's short-listen issue will be eliminated by using this method.

According to Alghamdi's [24] clustering model, the best way to minimize transmission latency in wireless sensor networks (WSNs) is to pick the cluster head (CH) in each cluster. On the other hand, choosing the best CH to provide prompt network service was the primary issue. Up until now, additional research has been conducted to solve this problem while taking various constraints into account. In light of this, this research looks at four main factors: energy, delay, distance, and security, in an effort to create a novel clustering model with the best cluster head selection. Additionally, the authors suggested a novel hybrid algorithm called fire fly substituted position update in dragonfly, which hybridizes the concepts of dragon fly and firefly algorithm techniques for choosing the best CHs.

A Topological Change Adaptive Ad hoc On-demand Multipath Distance Vector (TA-AOMDV) routing protocol was presented by Chen et al. [25]; it may enable QoS by adapting to high-speed node mobility. A stable path selection algorithm is proposed for this protocol, which takes into account the link stability probability between nodes in addition to the node resources (residual energy, available bandwidth, and queue length) as path selection parameters. Furthermore, the protocol incorporates a link interrupt prediction mechanism that modifies the routing strategy based on periodic probabilistic estimations of link stability, helping it adapt to the frequent changes in topology.

Decision gathering in cluster-based Wireless Sensor Networks (WSNs) is discussed by Alhasanat et al. [26] as having a significant impact on the overall performance of WSNs used for target identification applications. IM-based WSN (IM-WSN) is a recently proposed innovative technique for gathering decision-making that is based on the Index Modulation (IM) concept. In comparison with the literature, it achieves a significant improvement in the decision error rate at the cost of a high computational complexity. In this work, an effective method for gathering decisions is provided based on the same premise as the IM-WSN scheme. This system can greatly reduce computational complexity and improve the rate of decision mistake.

An analysis and comparison of the Multicast MDSR and MAODV with MACO's performance was provided by El-Sayed et al. [27]. A modification to the route discovery phase—where the route selection is predicated on determining the number of hop counts while computing the shortest path of route reply packets—is the focus of the proposed MDSR. Additionally, their MDSR modification is compared in this study with the Ant Colony Optimization (ACO) based evaluation technique that determines the optimal path and multicast tree that optimizes the multicast tree's overall weight (cost, delay, and hop count) using multi-objective optimization.

A variety of routing methods have been suggested to move data packets from source nodes to destination nodes, as Naseem et al. [28] explained. To reduce route re-discovery time, some of these routing systems have concentrated on providing multiple pathways for data transport. As a result, the overall latency has decreased. These multi-path routing techniques' primary goal is to distribute the load evenly among all or part of the accessible routes. For load balancing, however, choosing the right parameters is vitally critical. They created the load-balanced multi-path routing protocol (EE-LB-AOMDV) with energy limitations. The hop-count, round-trip time, and residual characteristics were used to first classify the various pathways. Data transmission only begins then, depending on the path's quality.

Hoang et al. [29] talked about a When a communication system needs to be quickly deployed without the use of any pre-existing network resources, mobile ad hoc networks, or MANETs, are the ideal solution. For example, after a natural disaster, a MANET can let rescue party members communicate with each other. In this situation, the routing protocol plays a significant role in ensuring that data-essential packets can be disseminated. However, the communication range of nodes, their high-speed mobility, and the energy capacity limits limit the backbone of any MANET, which is their routing protocol. By utilizing these features of MANET nodes, the authors' fault-tolerant ad hoc on-demand routing protocol (FT-AORP) establishes dependable pathways for data transfer.

In order to provide a trust-based, secured, and energy-efficient navigation method in MANETs, Srilakshmi et al. [30] demonstrated how to use the Bacteria for Aging Optimization method (BFOA), which determines the best hops to advance the routing. First, the fuzzy clustering method is triggered, and each Cluster Head (CH) is chosen based on how much direct, indirect, and recent trust they have. Furthermore, value nodes were found according to degrees of

confidence. Additionally, the CHs are using multi-hop routing, and the projected protocol—which chooses the best routes based on latency, performance, and connection inside the course's boundaries—is used to determine which route is optimal. The suggested secure optimization routing (BFOA) algorithm produced, even in the absence of an attack, a minimum energy of 0.10 m joules, a minimal latency of 0.0035 m sec, a maximum throughput of 0.70 bps, and an 83 percent detection rate when compared to the existing methods EA-DRP & EE-OHRA. These results were further improved by employing a selective packet dropping attack.

According to Yiwen Tao et al. [31], a malevolent user may skew channel estimation by sending out the same pilot data, which would impair secrecy capability and result in a biased estimate of Channel State Information (CSI). While many strategies have been put out to counteract PSA, the constant movement of both malicious and law-abiding users brings complicated time-varying features that render earlier static PSA detection techniques less appealing. A unique location-awareness dynamical PSA detection system was reported by the authors. A Random Finite Set (RFS) is developed to concurrently define the mobile positions and unknown attack status in order to model the complex dynamical behaviors. Using sequential Bayesian inference, the authors developed a hybrid system for PSA detection and user localization.

Table 1: An analysis of various wireless network routing algorithms, including their efficiency, benefits, and drawbacks.

S.No	Methods	Merits	Demerits	Efficiency
1.	Named Data Networking	In order to allow multipath forwarding, each prefix continues to have several next-hops.	Computational time is high.	Packet Loss Rate: Best Route 79.5 percent and Multi path is 14 percent.
2.	Topological change Adaptive Ad hoc On-demand Multipath Distance Vector (TA-AOMDV) routing protocol	The link stability probability between nodes is taken into account when designing a stable path selection algorithm, in addition to using node resources as path selection parameters.	High-speed scenarios that take node density and path stability into account are not supported.	Average Energy Consumption is 11.6 joules.
3.	Multicast DSR (Dynamic Source Routing) Algorithm.	After determining the number of hops, the route with the shortest path of route reply packets is chosen.	From the source node to the multidestination node, the multicast routing problem with delay and bandwidth is computed.	The Standard error mean rate is 1.26553.
4.	Load-balanced multi-pathrouting protocol with energy constraints (EE-LB-AOMDV).	Data transmission is initiated dependent on the path's quality.	It is possible to postpone the route re-discovery procedure until every possible node-disjoint path fails.	Packet Delivery ratio is 98 percent.
5.	Bacteria for Aging Optimization Algorithm (BFOA).	It determines the best hops to advance the routing and is used to provide a secure, energy-efficient, and trust-based navigation system.	Computational time is high.	With 100 nodes, this method produced an 83 percent detection rate, a minimum energy of 0.10 m

				joules, a maximum throughput of 0.70 bps, and a negligible delay of 0.0035 m sec.
6.	Location-awareness dynamical Pilot Spoofing Attack (PSA) detection mechanism.	It is possible to effectively increase the localization accuracy and PSA detection probability by utilizing the mobile patterns.	There is no support for various genuine user/eavesdropper scenarios in the PSA sequence length.	Achievable secrecy rate is 1.4 (bits/s/Hz).
7.	Fault-tolerant ad hoc on-demand routing protocol (FT-AORP).	To identify trustworthy data transmission routes.	To lower the overhead of protocol control, the route finding approach can be enhanced.	Path energy level of 80 nodes is 80.67 percent.

3. Discussion

The exchange of route information is the main process of routing; the optimal way to a destination is determined by factors including hop length, lowest power needed, and wireless link lifetime.The frequent and unpredictable creation and breaking of linkages is one of the main problems with mobility. They cannot cope with such rapid link changes if there are no established routers or stable links between an existing distance vector and multi-path routing methods.The main objectives of this survey include setting up and maintaining end-to-end connections, reliable end-to-end delivery of data packets, flow control and congestion control.After conducting a survey on wireless communication techniques, a framework of mechanisms that can effectively enforce access flow control of available network capacity was used to infer certain points that could be further studied in the future.

4. Conclusion and Future Work

Research on wireless sensor networks is one of the newest areas of study. Numerous novel and fascinating application areas for remote sensing are made possible by sensor networks' fault tolerance, flexibility, high sensing fidelity, low cost, and quick deployment. The analysis of the survey showed that several studies on various wireless network routing protocols techniques have been conducted. Due to the limited energy resources of sensors, energy efficiency is one of the primary problems in the design of routing protocols for WSNs. Extending the network lifetime by keeping the sensors running as long as feasible is the ultimate goal of the routing protocol architecture.
The main challenge in handling complicated tasks is incorporating knowledge into extremely dynamic networks. Based on the comparison of a variety of routing protocols techniques for MANET and the discussion of fault-tolerant, location, multi-path and secure routing protocols approaches. Combining several routing techniques can enhance efficiency even further, but the computation time is greatly increased. This work reviews a comparison of routing protocols and describes their benefits and drawbacks according to use.
In the future, wireless networks will use new hybrid routing protocols to boost energy and decree delays in new directions, resulting in a multitude of new and enhanced routing strategies.

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