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Powerful Efficient Multipath Routing Protocols For Mobile Ad-Hoc Wireless Networks

T. BHUVANESWARI[1] , Dr. Atul Dattatray Newase[2]

Research Scholar[1], Research Supervisor[2]

[1,2]Department of Computer Science, Dr. A.P.J.Abdul Kalam University, Indore, MP.

ABSTRACT
It is possible to create a temporary network of wireless mobile nodes without the need of any centralised infrastructure or management by using MANET. Because mobile nodes lack a fixed power supply and must rely on batteries to power their connections, energy consumption is a significant issue in MANET. This is due to the fact that batteries quickly deplete when nodes move and shift places fast across the network. To begin, this article explores the challenges of creating a routing system for ad hoc wireless networks and the many categories within that field.

KEYWORDS: MANET, DSDV, WRP, CGSR, STAR.

INTRODUCTION:

Mobile nodes (hosts) are linked by wireless connections to form an ad hoc wireless network. Network topology (the network's physical connection) can change at random in such a system. Ad hoc wireless networks have a highly dynamic topology, no established infrastructure for centralised administration (e.g., base stations or access points), bandwidth-constrained wireless links, and resource (energy) constrained nodes, making routing protocols that find a path from a source node to a destination node in traditional wired networks inapplicable. Recently, a number of routing techniques for wireless ad-hoc systems have been suggested. Despite the fact that wired network protocols locate other paths when a path is broken, the convergence of these protocols is incredibly sluggish. Ad hoc wireless network routing techniques must be able to efficiently and effectively handle mobility.

CLASSIFICATIONS OF ROUTING PROTOCOLS:

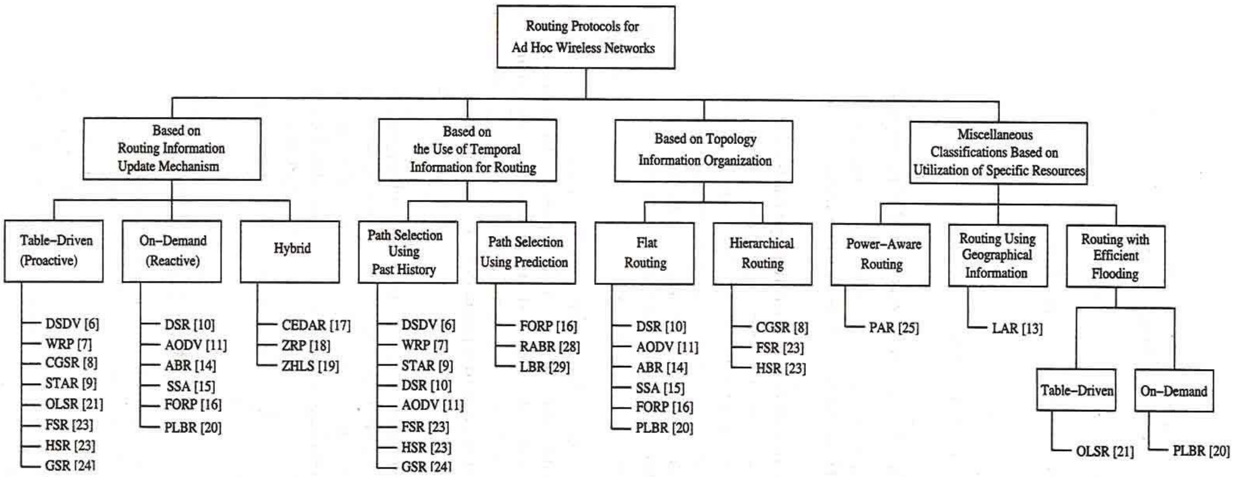


Figure 1. Classifications of routing protocols.

Several distinct criteria may be used to classify ad-hoc wireless network routing systems. Figure 1 depicts a categorization tree. Several classes, their features, and the underlying principles of classifications are addressed. Some protocols fall into more than one category, therefore the classification isn't a one-size-fits-all. Wired networks utilise routing metrics and path-finding techniques that are very different from those used in wireless networks. Ad hoc wireless networks' routing techniques may be roughly divided into four types depending on

- The mechanism for updating routing information.
- Routing based on time information
- The topology of a network's routing.
- Taking use of a particular resource

Based on the Routing Information Update Mechanism

The three basic kinds of ad hoc wireless network routing techniques are dependent on how routing information is updated. They're:

1. Routing protocols that are proactive or table-driven: Routing tables are periodically exchanged between nodes in table-driven protocols to keep track of the network topology. There is a constant flow of routing information across the network. A route-finding method is applied to the topological information that a node stores whenever it needs a path to a destination.

2. On-demand or reactive routing protocols: Protocols in this category do not keep track of network topologies. Connection establishment is how they get the road they need when they need it. Consequently, these protocols do not share routing information on a regular basis. '

3. All of the elements of the above two groups are combined into a single procedure. A node's routing zone encompasses all nodes within a specified radius of the node in question or inside a certain geographic area. A table-driven technique is employed in this zone for routing. The on-demand technique is employed for nodes situated outside of this zone.

Based on the Use of Temporal Information for Routing

If you're looking for a way to make routing decisions based on information about a link's history or its current condition, these protocols are for you. An efficient and stable path may be found by using a routing measure based on wireless connection availability (the current/present information) and a shortest path-finding method. A resource-intensive path reconfiguration may be required if the topological changes break the path quickly.

Protocols that take into account future events: This class of protocols uses information about the projected future condition of the wireless connections to approximate the split of the network. The future status information also contains information about the node's battery life (depending on the remaining battery charge and discharge rate of the non-replenishable resources), location, and link availability.

Based on the Routing Topology

Internet routers utilise a hierarchical routing design to minimise the amount of state information they need to have on hand. Ad hoc wireless networks can use either a flat topology or a hierarchical topology for routing because of their reduced number of nodes.

Protocols that employ a flat addressing system, like IEEE 802.3 LANs, are known as flat topology routing protocols. Nodes in an ad hoc wireless network are presumed to have a globally unique (or at least unique to the connected portion of the network) addressing mechanism.

Routing protocols in this category employ a logical hierarchy in the network and an addressing scheme connected with that hierarchy. You might have a hierarchical structure depending on geographical information or hop distance.

Based on the Utilization of Specific Resources

A major goal of power-aware routing is to save battery power in ad-hoc wireless networks, which is critical to the success of these protocols. The network's routing decisions are made with the goal of reducing power consumption at the local and global levels.

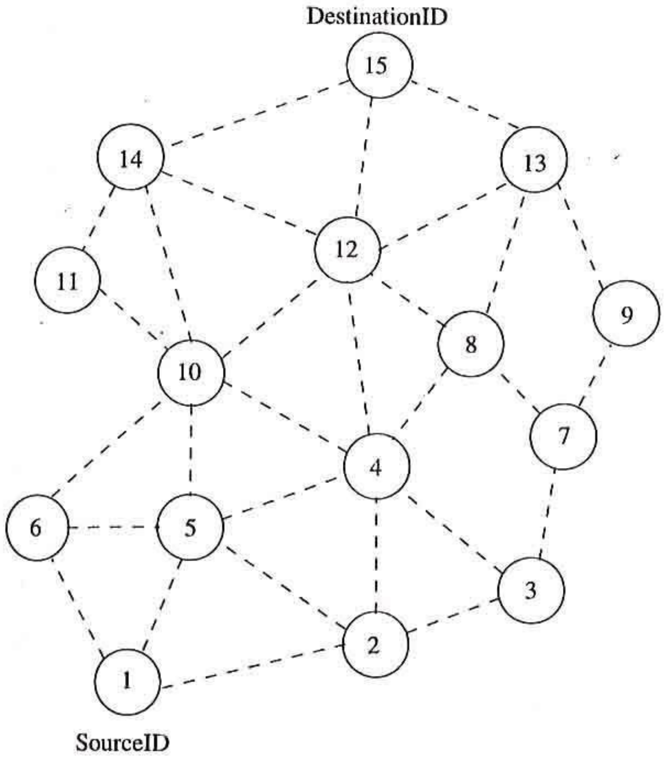
These protocols make better use of the available geographic information to optimise routing efficiency while also reducing administrative burden.

TABLE-DRIVEN ROUTING PROTOCOLS

Wired network routing protocols have been extended by these protocols. Every node has a table containing the global topology information. These tables are routinely updated to ensure that the network state information is correct and consistent. DSDV, WRP, STAR, and CGSR are some examples of protocols in this category.Wired network routing protocols have been extended by these protocols. Every node has a table containing the global topology information. These tables are routinely updated to ensure that the network state information is correct and consistent. DSDV, WRP, STAR, and CGSR are some examples of protocols in this category.

Destination Sequenced Distance-Vector Routing Protocol

One of the first protocols for ad hoc wireless networks was the destination sequenced distance vector routing protocol (DSDV). Enhanced Bellman-Ford technique where each node keeps a database with the shortest distance and the first node on the shortest path to all the other nodes in the network... The count-to-infinity problem is avoided, and updates to tables with growing sequence number tags are included for quicker convergence. Because it is a table-driven routing system, every node has access to all possible routes. The topology of the network is constantly being updated by passing the tables back and forth between neighbours on a regular basis. In the event of a major change in the local topology, the table is also transmitted. Incremental updates and complete dumps of the tables are the two forms of updates. It requires one NDPU for an incremental update, whereas numerous NDPUs may be needed for a whole dump. Nodes employ incremental updates when there are no substantial changes in the local topology. It is only necessary to do a complete dump when the local topology changes considerably or when an incremental update takes more than one NDPU to perform. A destination with a new sequence number that is always greater than the preceding one initiates table updates. In the event that a node receives an updated table, it can either update its tables based on the information received or hold it for some time to select the best metric (which may be the lowest number of hops) received from multiple versions of the same update table from different neighbouring nodes. It has the option to send or reject the table based on the sequence number of the update. Take a look at the sample in the following paragraphs. To get to the final destination (node 15), node 1's routing table shows that the quickest path is via node 5, and that the distance to it is 4 hops. The protocols follow the following procedure when it comes to rerouting a path currently being utilised for data transfer. The broken link's weight is set to infinity (()) and the sequence number is bigger than the recorded sequence number for that destination. The table update message is initiated by the end node of the broken link. It is the responsibility of every node in the network to immediately broadcast broken-link information to the rest of the network when it receives an update with weight(. As a result, even a single broken connection can cause table update information to spread over the whole network. To distinguish the link break update from the even sequence number issued by the destination, a node always gives an odd sequence number to it. Examine the example in which the node 11 moves, as illustrated in the diagram. For each path going across a broken connection, the distance is set to (.) by a neighbouring node.



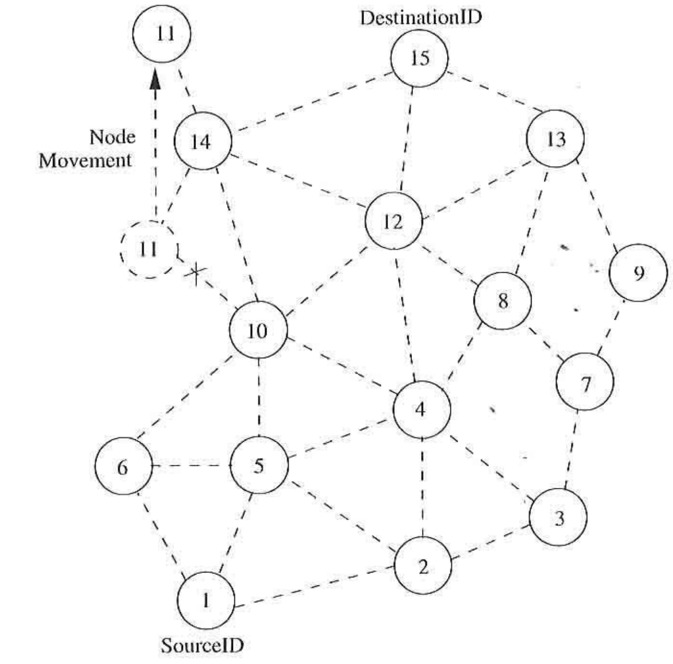
(a) Topology graph of the network

Dest	NextNode	Dist	SeqNo
2	2	1	22
3	2	2	26
4	5	2	32
5	5	1	134
6	6	1	144
7	2	3	162
8	5	3	170
9	2	4	186
10	6	2	142
11	6	3	176
12	5	3	190
13	5	4	198
14	6	3	214
15	5	4	256

(b) Routing table for Node 1

Figure 2. Route establishment in DSDV.

Node 10 sets the path to node 11 (and publishes its routing table to its neighbours) when it is aware of a link break. Significant modifications in the routing table of those neighbours have been detected by those neighbours. After receiving a table update message from No. 11, No. 14 notifies its neighbours of the shortest path to No. 11. Nodes 14 and 15. In addition, this knowledge spreads over the network. New tables were created for all nodes that received an update message with a higher sequence number. As of this writing, there are four hops between nodes 1 and 11 in the updated database at node 1.



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10	6	2	142
11	5	4	180
12	5	3	190
13	5	4	198
14	6	3	214
15	5	4	256

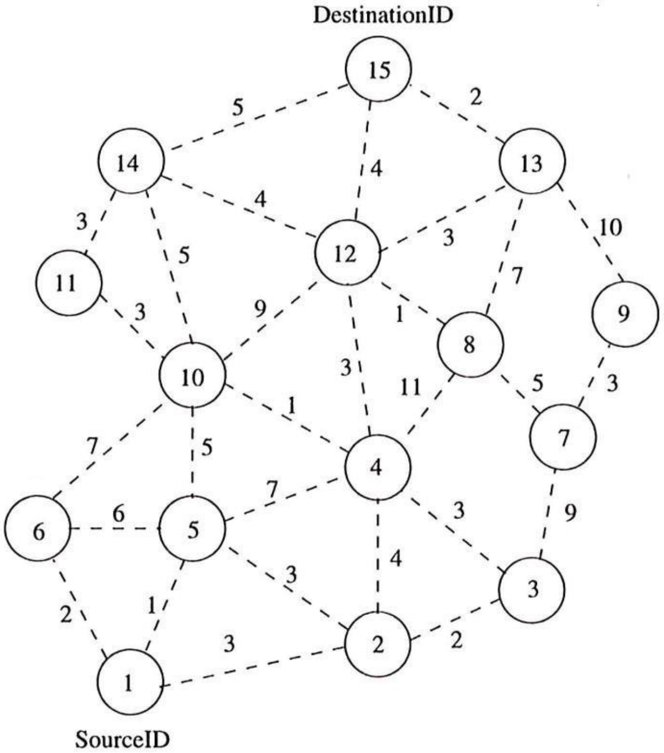
Figure 3. Route maintenance in DSDV.

Advantages and Disadvantages

Ad hoc wireless networks can use the current wired network protocols because of the method of incremental updates with sequence numbers tags.

Wireless Routing Protocol

Maintaining correct data is easier for WRP since it employs a set of tables. DT, RT, LCT, and a retransmission list? are the tables that a node maintains (MRL). A node's neighbours are seen in the DT's network view. For each destination, it provides a matrix that contains the distance and the last node supplied by a neighbour. RT includes the most current network view for all known destinations. Shortest distance, predecessor node (penultimate), successor, and flag indicating path status are all kept in a single location. You can have a simple path (correct) or a loop, or you can have the destination node unmarked (incorrect) (null).

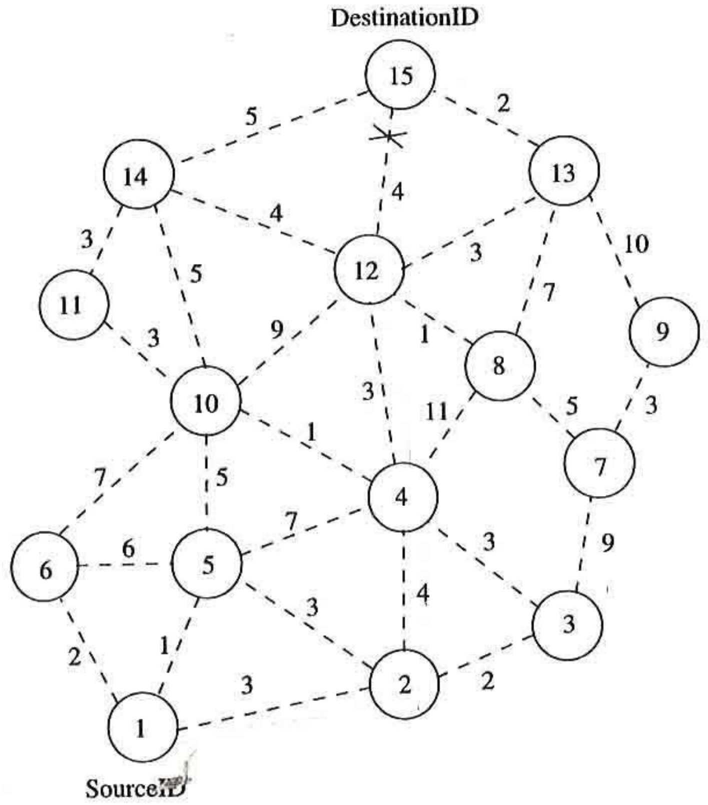


Routing Entry at Each Node for DestinationID 15

Node	NextNode	Pred	Cost
15	15	15	0
14	15	14	5
13	15	13	2
12	15	12	4
11	14	14	8
10	4	12	8
9	13	13	12
8	12	12	5
7	8	12	10
6	10	12	15
5	10	12	13
4	12	12	10
3	4	12	7
2	4	12	11
1	2	12	14

Figure 4. Route establishment in WRP.

Node 1 is the starting point and node 15 is the ending point of this route. Due to proactive maintenance by WRP, the source node always has access to the route to any destination node. The next node on the path from node 1 to node 15 is node 2, as indicated in the routing table. Node 12 is the precursor node to 15 on this route. When a connection fails, the predecessor information aids WRP in fast convergent. This message is sent out when a link break is detected by a node and the link cost is set to (.) Consider the situation depicted in the video. Whenever a link between nodes 12 and 15 is severed, all nodes that have a route to a destination with a predecessor as node 12 erase their routing records. Nodes 12 and 15 communicate to their neighbours that the cost of the link between the two nodes is (in their most recent update messages). The nodes update their routing tables if they have a different path to the target node 15 and send an update message to their neighbours.



Routing Entry at Each Node for DestinationID 15

Node	NextNode	Pred	Cost
15	15	15	0
14	15	14	5
13	15	13	2
12	15	13	5
11	14	14	8
10	4	13	9
9	13	13	12
8	12	13	6
7	8	13	11
6	10	13	16
5	10	13	14
4	12	13	8
3	4	13	11
2	4	13	12
1	2	13	15

Figure 5. Route maintenance in WRP.

It is only when a neighbour node receives an update message that the neighbour node changes its routing table. Node 12 transmits an update message if it discovers a new route to the target through node 13 for example. Neighboring nodes 8, 14, 15, and 13 don't alter their routing entries for destination 15 after receiving the update message from node 12, however nodes 4 and 10 do so in order to reflect the new updated path.

Advantages and Disadvantages

When compared to DSDV, WRP has the same benefits The convergence time is faster, and there are less table changes. Nodes in an ad-hoc wireless network must have more memory and processing power in order to maintain several tables.

Cluster-Head Gateway Switch Routing Protocol

A least cluster change (LCC) approach is used to choose the cluster-head dynamically. As a finite resource, bandwidth may be shared across several clusters through clustering, allowing for greater utilisation. The common member nodes that are part of both clusters serve as a conduit for communication between them. Gateways are nodes that belong to several clusters. Gateway conflicts can be avoided by using gateways with dual-interface capability. In this case, the routing protocol is cluster-based (hierarchical). From the cluster member table and routing table, a node with packets to be sent to a destination receives a token from a node in its cluster and retrieves the cluster-head and the next-hop node for the destination. Every node in the network may be reached by the path of least resistance, which is represented by the ith gateway and the ith cluster head, respectively, as follows: a– C1–G1–C2-G2–...Ci–Gj– Gn– b. typical members of a cluster and cluster gates.

Advantages and Disadvantages

With token scheduling and gateway code scheduling, priority scheduling systems may be implemented quickly and easily. Its key drawbacks are the lengthening of paths and the instability of the system when the rate of change of cluster-heads is significant. More resources (such as extra interfaces) are necessary in order to avoid gateway conflicts. When it comes to using power in a cluster, the cluster-head node's battery drain rate is higher than that for a typical node. These alterations might lead to frequent changes in the cluster-head and many route breakage.

Source-Tree Adaptive Routing Protocols

A node's source-tree is made up of the wireless links it uses to go to the places it wants to go. Every node generates a partial graph of the topology by connecting to its neighbours and receiving the source-tree broadcast from them. In the startup phase, each node updates its neighbours with a new version of the state information. There will be a route from every node to every other node. Most of the time, this would be a less than ideal route to choose. When a next-hop node isn't available, the link sends an update message to a neighbouring node with a different source tree signalling a different next-hoop node destination). The intermediary nodes are also important for preventing routing loops from forming. After receiving a data packet to the destination, an intermediate node K discards it in order to send a Route Repair message to the node at the head of its route repair chain. This message is transmitted safely and consistently to all nodes in its path. It's the path from the source tree (k) to the final router (x) in the data packet's path (k-d) that is the source of the route repair path. The Route Repair packet comprises the whole source tree node k and the path that the packet took to get to the destination node. Rout Repair update messages from intermediate nodes are sent to the head node reliably when they are received by a node that is in the middle of a repair path.

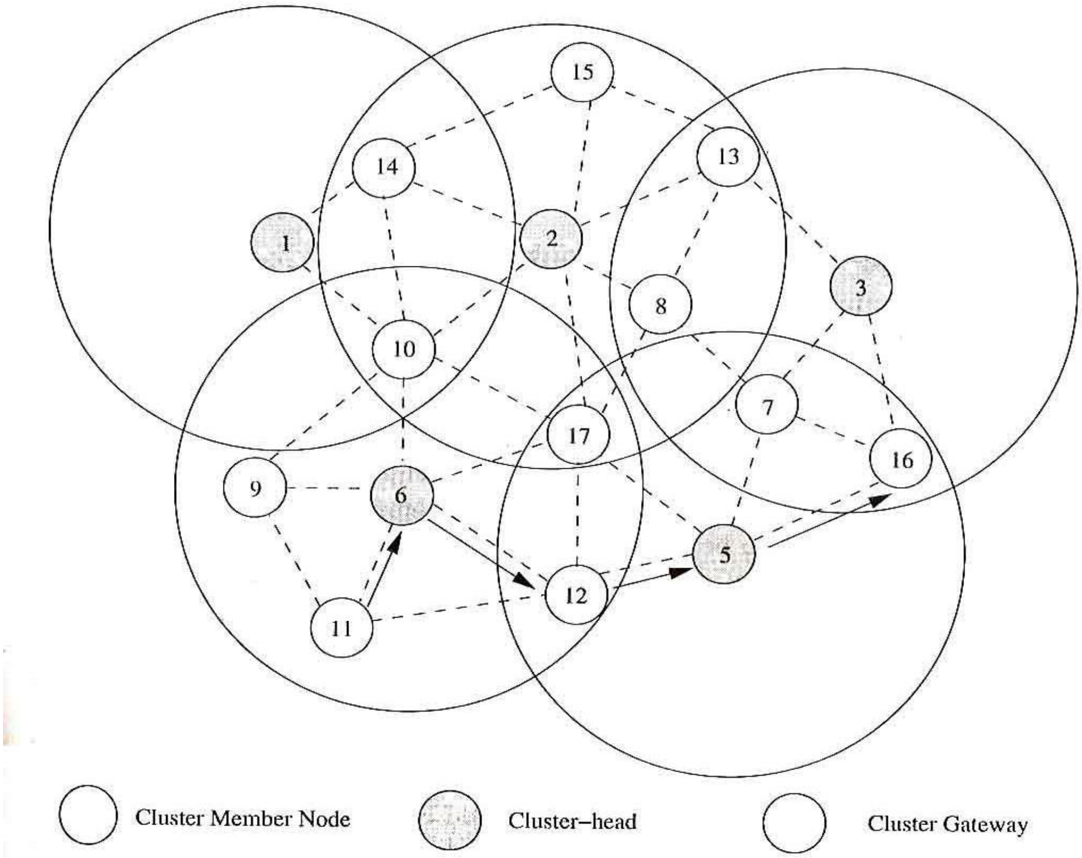


Figure 6. Route establishment in CGSR.

Advantages and Disadvantages

In comparison to other table-driven routing methods, STAR offers the lowest communication overhead. When compared to existing on-demand routing protocols, the LORA technique in this table-driven routing protocol minimises the average control overhead.

CONCLUTION:

For mobile ad hoc wireless networks, this study presents strong and efficient multipath routing protocols as well as classification routing protocols and table-driven routing protocols for classification. We'll go through how each node in the network is energy conscious, how overhead routing is taken into consideration, and how calculations are trusted. In order to increase the number of relay nodes and reduce the burden on the nodes, the energy of overhead mindful routing of grounded multipath would be retained. Ad hoc wireless networks are discussed in this study using more than one routing protocol. Nodes' mobility is one of the biggest issues for routing methods developed for ad hoc wireless networks. With the LORA technique, the average control overhead is lower than with other on-demand routing protocols that employ a table approach.

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