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Energy Efficient and MANET Routing Optimization

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ABSTRACT

MANETs can dynamically build a network in wireless networks without the need for a central hub or other infrastructure. For situations like disaster relief or military activities, these features will be useful. The network's stability and capabilities are impacted by the security and routing issues that arise from the lack of a central authority. In order to effectively address the problems, a suggested design takes the power factor into description when choosing routes. Utilizing the NS-2 simulator, these are simulated and integrated utilized and widely used AODV routing protocol. To ascertain how the suggested plan affects the network, we assess the simulated outcomes. The results of the simulation show that the recommended strategy greatly enhances network performance concerning stability and power consuming. The network's ability to sustain effective communication and lower energy consumption is positively impacted by taking the power factor into account when choosing a route. analysis based on reviews.

Keywords: AODV, MANET, NS-2

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1. INTRODUCTION

With the quick development of wireless networks, consumers can now access services and information via electronic media. People all throughout the world can now access to the internet quickly and affordably without a license thanks to this technology. Ad-Hoc networks are one type of wireless network in the network layer, which is the third layer. The dynamic and mobile nodes in these networks cause the network architecture to alter quickly. Although in this network every node will function since either a router and a host, the network's topology will frequently alter due to the nodes' dynamic nature. There are many possible uses for ad hoc networks, and they are especially useful in a number of domains. These networks are helpful for emergency missions, home networking, conferences, conventions, military operations, and catastrophe recovery (such as earthquake, flood, and fire) where information sharing is essential. Data collection and virtual classroom applications in difficult circumstances are appropriate for establishing contacts in exhibitions and promoting information exchange in military communications. The Paper follows the Structures Below: While Section 3 goes into further detail about the suggested algorithm, the Literature Review looks at the earlier.The final remarks are presented in the concluding section, while Section 4 uses NS-2 to conduct the performance evaluation.

2. LITERATURE REVIEW

Mobile ad-hoc networks (MANETs) will function reactively by utilizing the Ad-hoc protocol for On-demand Distance Vector (AODV) routing, which will be specifically designed to establish the route between the nodes only when necessary. Performance, security, and resilience are just a few of the features of the AODV protocol that researchers have recently studied. [21]The performance of Certain research have focused on AODV and looked at its consequences of various network characteristics, including node mobility and density. A new routing protocol that incorporates machine learning methods to enhance the PDR and reduce the E2E time was inspired by AODV. Their creative method outperformed the conventional AODV technique, according to the results. [19]Basic protocols that run on demand, like AODV and DSR are unable to handle high network loads because of the increased node mobility brought on by packet transmission delays that affect MAC (Medium et al.) contention. Mobility messes up established pathways, and fixing them uses more battery power. The energy resources of participating nodes are also depleted by flooding RREQ and RREP signals. Energy consumption is quite low even for base stations that receive these broadcast messages. Two popular routing protocols used in ad-hoc networks are AODV and DSR. AODV only creates routes between nodes when necessary. When a node wishes to send a packet to another node without a predetermined path, it sends the RREQ packet along all of the outgoing paths. After the RREQ travels throughout the network, a routereply (RREP) packet is sent back to the source, establishing a path for packet transmission, when it reaches a node that either has an existing or potential route to the destination or is the destination itself.[18,19,22] An energy-efficient AODV that uses the Expand Ring Search (ERS) method to find routes, which successfully lowers energy usage by preventing RREQ packets from being rebroadcast twice.They carried out the research using AODV as the base protocol. [33]In an AODV-enabled network, a link break triggers an RERR message, which is then broadcast to its neighbors by the node-detecting link break. These neighbors then spread the RERR message until all nodes with a route through the broken link must be notified. The route discovery process then starts to look for another possible route to the destination based on available neighboring nods. This improves the capability of AODV by using power-based path selection. This protocol determines how many hops the data packet has crossed and how many hops are yet to go. It activates an energy-boosting path if the number of hops traveled surpasses the number of hops left if not, it chooses an different route. When the network load is heavy, this protocol performs well. [4]To reduce the energy usage of AODV, the authors used network coding in the ANC scheme. By combining the AODV routing procedure with network coding, the authors were able to lower energy usage and transmission of data. They also added a buffering mechanism to intermediate nodes so that incoming packets might be stored there before being integrated with the coding scheme and sent. [10]The authors introduced HP-ERS-AODV, which uses patterns of wireless devices connected to people to estimate the destination node's most recent location. Making use of time-to-live values minimizes the amount of request messages that are sent again. [11]In order to create SP-AODV, the authors added a flag value to the RREQ packet after modifying AODV. Additionally, they incorporated two constants, MinTH and MaxTH, that regulate the value of a new field in the routing protocol called the counter table. A node's estimated time to reach its destination is indicated by the counter value, which is either increased or decreased depending on the constant values. [12]A system based on auctions for end-to-end routing in order to prevent resource waste. Using factors like current energy and digital currency, the Vickery auction raises the price when the energy level falls, and vice versa. Selfish actions, however, may not always result in positive outcomes. [13]IMAODV, which provides multicasting and reliability in a wide network region, combines AODV and MAODV. Bi-directional shared multicasting trees are established by this protocol if all group members stay on the same network. [7]Proposed using the EMAODV algorithm to increase the lifespan of networks. This algorithm considers the energy levels of nodes to optimize their usage.

3. PROPOSED APPROACH

The main goal is to guarantee the route's reliability and energy efficiency. It alters the AODV protocol through smooth integration. RREQ and RREP are the route request process are its two main phases, and they are primarily focused on various data traffic volumes. In this updated version of AODV, each node adds additional power-related data to its routing table. There are different degrees for the node's battery status; the lowest or most unstable state is called the critical battery status, which disqualifies the node from inclusion. In contrast, the battery's Active status signifies that its value exceeds a predetermined assigned value.Whenever a path is necessary, the structure determines the route based on the node's condition. Route Establishment: This approach makes it easier for the party making the request to choose a suitable node sequence via the path.

Session

(1) Initially ,Pi=0

(2) For each valid path Pi

(3) For each node N in Pi

(4) IF current battery status=active state

(5) Then

(6) Include node in the path and broadcast RREQ to the intermediates nodes Ni.

(7) END IF

(8) At the source node S,scan all RREPs

(9) RREP with the shortest active route and CURRENT Battery STATUS > MIN_BATTERY is selected

(10) Forward Data

(11) Else

(12) Exclude node from the path

(13) Then

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(14) Sent RREQ to the selected node

(15) Then

(16) Forward the RREQ on the available active route

(17) Destination node d sends back RREP on the reverse path

(18) Source node S receives RREP

(19) Route is established

(20) The established route forwards data

(21) End For

(22) End For

4. SIMULATION SCENERIO

We changed the format of AODV by adding battery status, implementing the aforementioned methods. We examine and evaluate the M_AODV's activities via EDA simulation.The simulation used NS2[15][28].We took into account the following metrics during the simulation study: PDR, throughput, E2E delay, and control packet sending and receiving.We took into account the following metrics during the simulation study: PDR, throughput, E2E delay, and control packet sending and receiving.

SIMULATION PARAMETER	VALUE OF PARAMETER
Number of Nodes	100
Analyse Time	100
Protocols	Ad-hoc On Demand Protocol, Modified Ad-hoc On Demand Protocol
Pattern of Traffic	Constant Bit Rate(User Datagram Protocol)
Size of packets	512 kilo byte
Duration of the simulation	500 seconds
Area of Simulation	700mtsX700 mts
Tool for Simulation	Ns-2
Measure of Performance	Packet Delivery Ratio,Throughput,load of Routing

End-to-End hold-up versus Number of Nodes:

The E2E latency, which measures the amount of time it takes for a packet to go from its source to its destination, is the main performance metric used to determine how effective AODV is. The performance of AODV can be greatly impacted by the size of the network, depending on the quantity of nodes. The necessary probability of network congestion and collisions increases with the number of nodes, leading to an extended end-to-end latency.Delays are also exacerbated by the overhead of routing and control messages, which rises with the number of nodes. Delays and path discovery time are impacted by the network's rising complexity as a result of more nodes, which could lead to longer delays. More nodes in the network, however, can offer more channels for communication and raise the likelihood of discovering a workable route to the target. For AODV, there is therefore a trade-off between the number of nodes and end-to-end latency. The effectiveness of AODV and Modi_AODV with respect to complete latency is show in Fig 1. There are not able variations in the high end-to-end delay when taking into account the current AODV. Modi_AODV, on the other hand, attains a lower and more consistent end-to-end delay ratio.

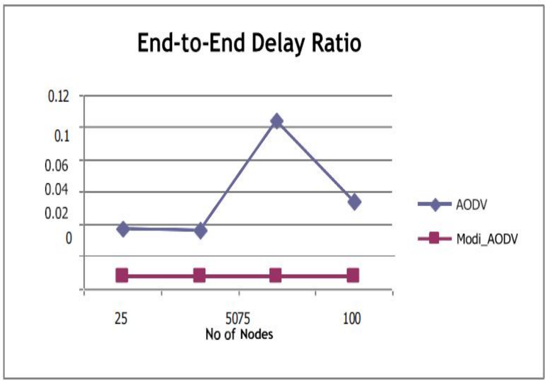

Fig 1: End-to-End Delay comparison if different Number of Nodes(100)

Throughput versus Number of Nodes: Throughput, which is commonly measured in bits per second (bps), is a measurable indicator of the amount of data that is sent over a network in a given amount of time. A number of variables, such as the quantity of network nodes, the amount of traffic these nodes create, as well as their capacities —such as computing interfaces of power and wireless—can affect throughput for the AODV protocol. Total amount of traffic generated by the network grows with the number of nodes, which could result in congestion and decreased throughput. The effectiveness of the AODV protocol will also be strongly impacted by the number of nodes in the network.

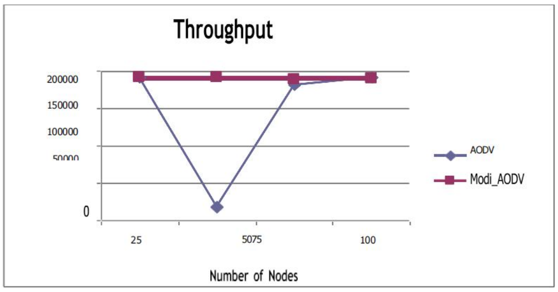

Figure 2: Throughput using Number of Nodes(100)

Higher lengthier lookup times for routing tables and overhead are the results of having more nodes, which increases the number of routing tables that need to be maintained. The overall performance of the network is impacted by the overhead and complexity that an increased node count often adds to the routing protocol. To achieve optimal performance, it is critical to balance the number of nodes in the network, overall performance, and the desired amount of throughput.The throughput efficiency of AODV and Modi_AODV is shown in Figure 2. While the throughput with AODV is still somewhat poor at 50 nodes, it performs better at 25, 75, and 100 nodes, following Krung M et al.'s 2002 study [33]. On the other hand, Modi_AODV displays better and improved stability in performance. The percentage of packets that reach their intended destination is represented by delivery rate of Packets in relation the quantity of nodes. On the other hand, the variety of nodes represents overall of the network's devices. Network becomes more complex as the number of nodes varies, which could lead to a decreased packet delivery ratio. The probability of disruption or packet collisions , which results in packages that are delayed or lost, rises with the number of nodes. Furthermore, larger routing tables brought about by additional nodes result in higher overhead and delays. However, because they can quickly and precisely find routes between nodes, effective routing protocols like AODV can lessen Node count's effect on packet delivery rate.Important information including the destination, source addresses, and the destination's current sequence number are all included in the RREP packet.To make sure that the packets don't go above a certain hop count, the RREQ/RREP packets might set a hop count as a restriction, preventing loops and restricting the size of the broadcast domain. Furthermore, when the time-to-live (TTL) value in the RREQ/RREP packets hits zero, the field stops forwarding.

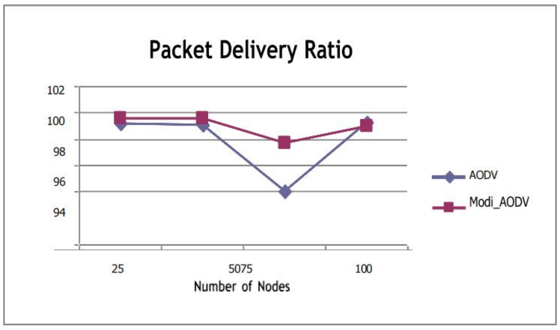

Figure 3: Packet Delivery Ratio using Number of node(100)

A comparison of AODV and Modi_AODV with respect to the Packet Delivery Ratio statistic is shown in Figure 3. Modi_AODV performs better and is more reliable than AODV, which has low and erratic packet delivery ratios.The identification and creation of routes between nodes in a MANET depends on Route Reply (RREP) and Route Request (RREQ) packets. The process starts The moment a source node sends out an RREQ packet with pertinent data, like the address of source and destination, a distinct broadcast ID, and the source node's current sequence number, in the event that it does not have a route to a destination.The RREQ packet is forwarded by the receiving nodes until it reaches the end node or nodes that have already forwarded it based on the broadcast ID and source address. Once the midway node with a newer terminal or route node .A Route Reply (RREP) packet is returned to the source node by the destination. The destination, source addresses, then the destination's current sequence number are among the crucial details included in the RREP packet.By restricting the size of the broadcast domain and preventing loops, the RREQ/RREP packets can establish a hop count as a restriction to make sure the packets don't go above a predetermined hop count. Furthermore, when the time-to-live (TTL) value in the RREQ/RREP packets hits zero, the field stops forwarding.ratiometric delivery. Modi_AODV has low and erratic packet delivery ratios, whereas AODV does not exhibits improved and continuously steady performance.

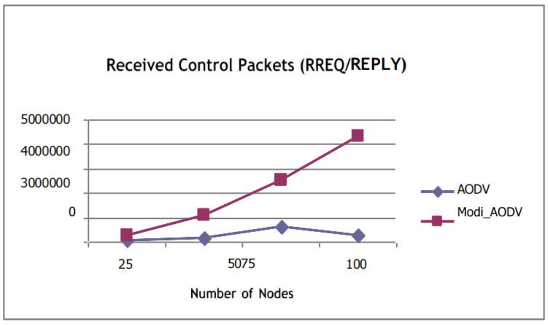

Figure 4: Received Control packets (RREQ/RREP)using Number of Nodes(100)

The received control packet Comparison of AODV with Modi_AODV's performances is shown in Figure 4. The quantity of Received Packets of control in Modi_AODV scenario is greater than AODV, just like in the Send Control data.

CONCLUSION

It is clear from the analysis of throughput, PDR, and E2E delay that Modi_AODV performs better than AODV in terms of network performance. Significant gains have been made because to the optimization strategies used in Modi_AODV, which include using node position information to lower control overhead and improve routing efficiency. With reduced E2E latency, increased throughput, and an improved PDR, this improved protocol exhibits overall increased efficiency in mobile ad hoc networks.The results show that these performance improvements are a result of the changes made to Modi_AODV in comparison to the original AODV algorithm. Using a path stability mechanism streamlines the route discovery process, increasing network efficiency. It is important to remember that a routing protocol's effectiveness depends on the particular network characteristics and conditions, which can vary depending on the circumstance.

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