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Research Article

Stable Route Selection for Adaptive Packet Transmission in 5G-Based Mobile Communications

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In mobile nodes in the network, they are unstable, so single-path communication does not provide sufficient results. In the alternative single path, communication is very difficult to handle the heavy load. The poor connectivity among the mobile node makes the uncertainty of packet loss; the path link is not measured in this network. The communication cost is also focused to achieve valid packet transmission. Because the high distance path selected for packet transmission causes a high cost for communication. It increases energy consumption and packet loss rate. So, the proposed dispersed path selection for communication (DPAC) method is constructed to obtain the best minimum distance routing path, this path operates with the help of queue variation that handled the data packet's maintenance, and the time slot exceeds its limit. Packets are kept waiting, to increase the packet broadcasting efficiency. The multipath jamming detection algorithm is constructed to provide link-based path packet overload detection scheme to identify the packet overload. Also, separate the path based on its characteristics, to control overload. It reduces energy consumption and packet loss rate.

1. Introduction

MANET is a network having a lot of wireless mobile nodes which share data packets with the nearest neighbor node that cause missing data packet collection. The main goal of this paper is to (a) provide a stable route selection for adaptive packet transmission; (b) propose an adaptive routing protocol for 5G mobile networks; (c) increase lifetime of the network by reducing packet delay, energy consumption, and packet drop; and (d) compare the proposed methodology to the previous reference routing protocols using NS2. The sender node searches the characteristic of the mobile node, and it discovers the better path to transmit data packets frequently [1]. Nodes are also movable at all times; nodes successfully reach the destination node constantly in every time instance. Mobile network obtains growing techniques for security applications in the network. Because the standard of packet sharing is wireless with a limited transmission rate. For mobile networks, there is infrastructure less network with the topology strength energetically alteration in a spontaneous method because nodes are not busy to travel in very surrounding environment [2].

Mobile network every node has a locality of management. This frequently transmits the data packets without overhead occurring for communication by various mobile nodes, and it can disrupt other communication. Network energy usage is also a very vital measurement for increasing communication characteristics [3]. In difference to tense nodes in the environment, the mobile network has a lot of nodes that contain limited energy and transmission speed. The particular behavior of mobile nodes causes a discrepancy in effectiveness and equality in communicating analysis. For a particular time, it should obtain unstable communication [4].

Strength monitors the success rate of packet acceptance by using multiple paths, which is the maximum and minimum distance between the source node and destination node, while equality needs to hand out the load extra regularly crossways the mobile network. A lot of packets are lost at a similar time slot as an extreme amount of data packets construct a network obstruction [5]. Data packets that are lost should be crossing a minimum distance, and in gathering, the lost packets regularly set in motion the option of rebroadcasting. The flow of data packet start received from many sender nodes and everyone would like a similar output queue [6].

Throughout the condition routing, a path is constructed. Whether there does not hold all the data packets, the data packets are dropped. Improving the remembrance of the memory size of nodes to unrestricted storage size is not easy to solve issues [7]. This is frequent packet transmission as obtaining the output by the particular time slot packet reaches target node from packet holding buffer that needs earlier usual output. On one occasion, timer crack supply transmits replacement of data packet which is also waiting in the queue. Consequently, similar data packets are overloaded additionally, maximizing the traffic rate in the network environment, as well as the major motive of intrusion in mobile structure. It intimates that even extra packets are transmitted along the mobile nodes in the network environment [8]. The transmission rate is immobile more declining by the network failure.

There is potential for intrusion crumple everywhere; approximately wrong data is received with achievement whether no suitable intrusion management is processed. The data packet estimate of the connection among the mobile nodes is not possible to support considering that the severe overload occupied the network environment [9]. The proper traffic management scheme is required to manage the overload of the unstable network by handing it out or increasing the procedure ability of mobile nodes by constructing certain source nodes to obstruct its packet overload. The technique guarantees that the available transmission rate within the network is utilized quickly by distributing overload uniformly which ensures maximum traffic equalization and intrusion balancing [10].

The contribution of the proposed work is as follows:

(i) Expand the channels used for communication by providing an improved way of communication from sensors in a different place

(ii) Encourage administrators, who are in charge of object management remotely, to use automated controls

(iii) By providing accurate estimates to assess the status of equipment from a remote place, you may reduce the general expenses that are incurred from beginning to end (i.e., from designing to maintenance)

Jamming is a well-known danger to the wireless community and is growing in importance as more security-critical applications are developed. Current networks must be designed with a jamming detection mechanism to defend against smart jamming assaults, in which the attacker secretly jams the network at irregular intervals to seriously harm wireless networks. The majority of current detection methods use network nodes to gather data about the network, which adds overhead and communication costs to the nodes. In this paper, we propose to address this problem by developing a passive, non-node-centric, low-overhead network jamming detection technique utilizing machine learning algorithms.

In order to divert traffic over backup pathways, procedures for restoration or protection switching are triggered by link or node failures. The normal and backup traffic then carried down these pathways, which may result in overload and subsequent quality of service (QoS) violations, such as excessive packet loss and latency. Although links are not overwhelmed during regular operation, this aids in locating network weak points and upgrading their bandwidth as necessary. We put the idea into practise via a software solution that enables network providers to foresee future overload in their networks before failures and expected alterations (new infrastructure, new routing, new customers, etc.) and to take the necessary steps. The residual of the paper is designed as follows. Part II provides related works. Part III presents the details of the proposed dispersed path selection for communication (DPAC) method constructed to obtain an efficient and shortest distance routing path. The multipath jamming detection algorithm is designed to obtain connectivity depending on packet loss detection in the routing path. Part IV provides simulation performance result analysis obtained under various metrics. In the last part, the paper is concluded with the future process.

2. Related Works

Mallapur et al. [11] presented that MLBCC launches an intrusion management method which manages heavy traffic using this scheme for load managing method when the communication is performed. The intrusion management method should identify the attacks by analyzing the packet success ratio for a departing rate at a specific time slot. The traffic controlling method is based on the choice of the intermediate node with the connection rate and the route rate to powerfully hand out the traffic by choosing the mainly attractive routes. For a proficient transmission of data packets, node density-based metrics are analyzed. In experimental output, the present method achieves maximum packet success rate, lesser latency, and packet loss.

Giacobbe et al. [12] presented the efficient association energy organization method used for optimizing the assigning of geologically positioning of efficient sensor nodes. Describe the model of node grouping as a mesh for information sharing nodes which is organized to obtain a common network monitoring data, and nodes are active to organize data packets frequently. Specifically, an energetic method is used to increase energy sustainability in federate schemes. Analyze a use-case-driven method which permits each intermediate node; it fails to transmit packets on the specific route to attain a particular target node with minimum resource usage.

In an energetically efficient trip sequence using the least amount of energy possible, the intrusion technique is provided by Sunitha et al. [13] and causes failures whenever the COR-path occupied ratio reaches a higher threshold rate and the arriving signal strength is lowest compared to a lower threshold rate. Subsequently, the intrusion management method should balance the packet transmitting ratio; the source node by determining accessible transmission rate, latency is made, because of poor connectivity among nodes. The present method's experimental output shows a better packet success rate, lesser packet latency, and minimum energy consumption.

Nirupom et al. [14] suggested that many path communication is monitored, and various techniques are used for the communication, to increase the packet success rate with minimum traffic. In a specific network, there are many path communication methods allowing for intrusion among available routes. That technique is used to obtain a better transmission rate, though this operates below the statement for all nodes and grasps the location details of each node in the proceeding. Consequently, this does not use in a few active mobile network structures. Recently, many path communication techniques allow for intrusion among the available routes lacking a statement of greedy location details in the proceeding, restricting the amount of data in an effort to boost transmission rate.

Rekik et al. [15] selected the better, well-organized, and accurate communication method used to transmit a packet to their deadline within the mobile network environment. It launches the energy latency aware based on energetic foundation communication. The present process resourcefully utilizes the network property like a relay node energy level and then traffic occurrence to manage the packet loss. This guarantees each suitability and energy effectiveness by rejecting the minimum power with data forwarding by relaying nodes. The experimental output of the proposed method shows a better packet success rate, and minimum packet latency should be compared with the existing method.

Yang and Huang [16] proposed that energetic many path source-based communication method is used to enhance existing on-demand communication method. It contains important various parts, specifically path detection, many path communication chosen, and communication path preservation. In many path communicating chosen, the perfect quantity of many path communication is obtained to cooperation among the traffic managing and traffic occurrence. The experimental output indicates that the method outstandingly improves packet success rate with minimum traffic occurrence. This offers a valuable result for wireless packet sharing.

Hiremath et al. [17] present that preparation is a method that many issues and procedures get way into network property. Preparation methods increase the value by assigning packets forwarding to the queue waiting state. Communication is the transmission of the data packet and details against the interconnection from the sender node to the base station node. The important aim of the method is used to determine the optimized route from the sender node to the target node for forwarding packets. Presenting technique is swarm intellect used to discover the efficient route for transmission of data packets and detail. To allocate the packets based on the preparation scheme, energy consumption of the routing path is reduced.

Hu and Zhang [18] proposed an optimized connectivity condition communication method in multiradio else many paths in the wireless network. It is efficient by the OLSR (optimized link state touting) method in the mobile network. This deals with data overload between diverse many routes to reject intrusion and increase the path transmission rate significantly. This uses novel parameters such as enhanced biased culminate approximate relocate instance to estimate path superiority. The present path assigning method and path preparation method provide the capability of controlling traffic. The simulation is performed, and the output confirms that the present one is not simply preserving the advantages of strength and performance in the OLSR method. It reduces the link damage among nodes and increases the throughput of the network distinguished from the previous method.

Rathore and Khan [19] presented ant colony optimization based on many path intrusion managing methods by altering the waiting queue based on the traffic in an energetic network structure. The ad hoc distance vector routing method is used to manage the traffic provided that various routes except not capable at all states. The ad hoc distance vector routing method is used to obtain the many routes for data transmitting. In the present method, many path chosen depends on the pheromone rate, not on the origin of the minimum distance path, and the achievable queue dissimilarity is managing the data packets which exceed the determined queue range. The queue range is improved; also, the maintaining and transmitting potential of nodes is increased. The present traffic management method has resourcefully managed the traffic in the network environment. Whether the node organism a quantity of node goes out of limit, then the present method minimizes the traffic return of link among the source and target node. This present method is used to increase the communication by pheromone depending on the path chosen. The experimental output showing a better routing path should be compared with the existing method.

Zhou et al. [20] presented a path assigning scheme to process the path usages by analyzing the path difficulty of connectivity and transforming the various issues into an equivalent linear programming issue. Adopt the irregular pathfinding technique of multipliers to optimize the run values. Because extreme rates are assigned to routes to temporary the similar connection, value alteration is present to guarantee the transmission rate needed for all routes. The experimental output displays a better meeting of the present distributed method with the enhancement with value alteration against the ad hoc network. When the characteristics are responsive to the outage possibility of the connection, improving the connectivity ratio does not significantly increase the possibility of discovering an efficient path. The minimum coverage limit of nodes is identified and removed from the network environment.

Kavitha [21] proposed that the transmission of the packet could be difficult if we load it extra more than the capability. To avoid that, ISPA technique is used to overcome it.

3. Overview of the Proposed Scheme

In a mobile network, nodes are movable characters; they travel in any direction along the mobile environment. Sender tries to forward the packet consequential to the target node. In the optional single path, packet sharing is very difficult to manage the overload, during communication. The weak connectivity between the mobile nodes is obtained packet drop unpredictably; the routing node connection is not analyzed. The packet transmission cost is also determined to obtain valid packet sharing. Since the maximum distance path is chosen for forwarding, data packets make maximum cost or resource utilization. It improves energy usage and packet drop level [22–33].

Then, the suggested method to find the most effective and shortest distance communication path, the dispersed path selection for communication (DPAC) technique, is used. These paths should be processed with the aid of a queue dissimilarity, which is managing the maintenance of data packets in the queue, and the time slot exceeds its border during communication period. The queue has space allotted for data packets, which should make communications more efficient. The goal of the multipath jamming detection technique is to establish a link based on the detection of path packet overload in order to ascertain the data packet traffic rate. In order to control the level of traffic, it also separates the route based on its behavior. It reduces energy consumption and the percentage of dropped packets.

Figure 1 shows a block diagram of the proposed dispersed path selection for communication (DPAC) technique. Analyze the distance for multipath packet transmission from the particular source node to the destination node. The multipaths are used to obtain different transmission rates. In order to isolate the effective path from the network and improve packet delivery ratio, a dispersed path selection approach is used to distribute packets across different paths based on packet success rate. It obtains the efficient and minimum distance routing path to reduce resource utilization. A multipath jamming detection algorithm is used to detect the packet jamming occurrence for every transmission from the sender side to the target side in the network. Finally, this provides packet overload-free communication and also reduces energy consumption and packet loss rate.

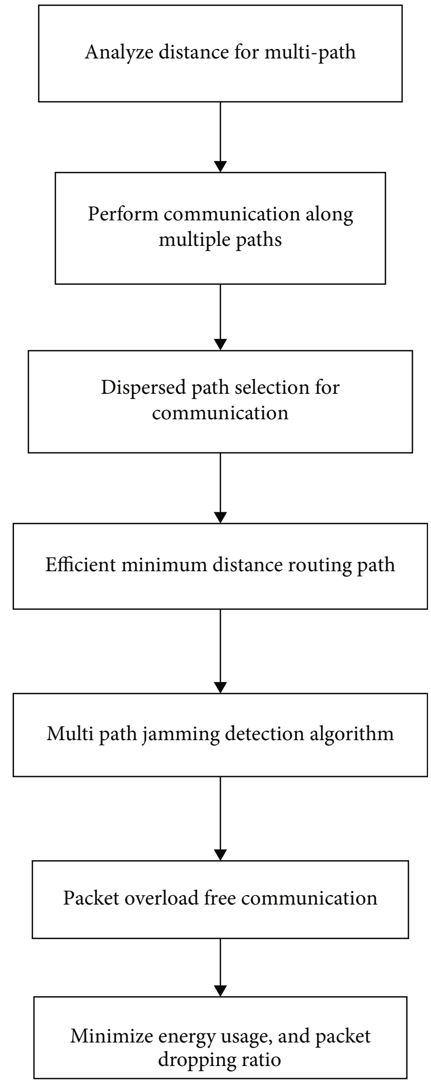

Figure 1: Block diagram of proposed dispersed path selection for communication method.

3.1. Analyze the Distance for Multipath. To measure the distance between mobile nodes which are present in the routing path, there are multipaths available in the network. It depends on the hybrid communication method, which is positive when trading with nearest neighbor nodes and unconsidered when trading with nodes that are beyond gone. Order the node distances from minimum level to maximum level, and traffic strength as the distance is fewer also makes the packet latency. Ordering time utilization from the highest to the lowest level is necessary for both bandwidth and energy consumption, as the highest transmission rates send an enormous number of packets across the shortest distance possible. Even though the transmission rate is reduced, there is still a lot of traffic since it increases the maximum amount of time that data packets can wait in a queue. It shows that only transmission rate cannot be suitable for genuine applications. The metrics of network processes are transmission rate, packet overload, latency, and energy usage. Select optimal path from the source node to destination node for multimedia communication to obtain better transmission rate. Mp is the multipath, $V(D)$ is the various distances, and Er is the energetic routing.

$$\begin{aligned} Mp &= V(D) * Er-, \\ V(D) &= SD + HD-. \end{aligned} \tag{1}$$

In the communication route finding procedure, the distance of path is one of the factors which should allow for packet transmission. Dynamic source routing is accurately initial from the design of minimum node count. Initially, to place an optimization method of the maximum amount of remaining energy level, the main goal of the network indicates the maximum packet transmission in the network environment and obtains the higher residual energy of the nodes to balance the heavy traffic. In communication route chosen as a process, it requires selecting the major network overload; that is, the balance energy of the jammed nodes in the particular routing must have a high potential that supports increasing the lifespan of the network. $\text{Min}\, D * ts$ is the minimum distance within the allocated time slot, $\text{Min}\, D * ts$ is the maximum distance within the allocated time slot, and $P1 + P2 + Pn$ is the paths.

$$\begin{aligned} V(D) &= (SD + HD) * P1 + P2 + \cdots Pn-, \\ SD &= \text{Min}\, D * ts-. \end{aligned} \tag{2}$$

The network nodes should link with the nearest neighbor nodes based on the link set. All nodes in the network should be unique identifiers. The source node is the identifier, and also, the target node is the identifier; the remaining nodes are relaying nodes in a particular path. There are multiple paths available to transmit data packets frequently along the network environment. The dissimilarity from the abovementioned nodes links connection, which is known as the capability process in each node point, of the ability process at the boundary.

$$HD = \text{Max}\, D * ts-. \tag{3}$$

This is understandable that the packet overload among the mobile node must not be higher than the altering capability. It is well matched with the description of the jamming node in the network environment. The equivalent node communication has the maximum bottleneck node residual energy through each available transmission. To transmit data packets with higher residual energy when using the least distance routing path approach, an optimization scheme with a higher remaining energy level has been launched. This is an essential design created from the plan of less cost, and the maximum transmission path is selected among multiple routing paths. Communication finding technique that suspiciously reflects the degree of reserve and remaining energy of each node inside the network structure, which completely reflects the energy management strategy. Keep away from nodes with lesser remaining energy in the procedure of the communication path chosen. It not only elevates network effectiveness but also extends the network lifetime capably.

3.2. Dispersed Path Selection for Communication. A maximal source coverage scheme is applied for energy in the sensible area by altering the path based on routine energetical value. This is one of the simplest and the first adaptive methods present for energetic modification of time slots regularly. The scheme sender transmits the packet considering time slot allocation; it exceeds the allocated time slot that path is separated and only uses an efficient routing path for further communication; the maximum amount of nodes for all the energetic senders should be ready for communicating with the next neighbor node. Important merits for sender searching the coverage scheme are constructed and applied to maintain increased packet success rate and decreased communication overhead rate. It provides a feasible routing path for packet transmission. The disadvantage of the method is that even if a single sender node is placed at a more distance from the intermediate node in a particular area, it needs to improve the coverage of the node, which causes a maximum communication overhead rate.

$$V(D) = (\text{Min}\, D * ts + \text{Max}\, D * ts) * P1 + P2 + \cdots Pn-. \tag{4}$$

The proposed method expands the routing path in the altered report of maximal sender coverage for the energetic alteration of time slot allocation that conquers the demerits in network structure. Launch two recent metrics such as energetic neighbor node finding and minimum distance pathfinding. The multipath communication is established, and the available number of energetic neighbor nodes is separated. To verify the routing path before initiating the packet transmission, using earlier than transmitting packets guarantees that communication overload is caused based on a lesser packet success rate. Simply while the amount of reactive active sources needs node links with each other, it should attain an assured threshold level distinguished with positive energetic sender nodes, the particular coverage range should reduce the packet overload.

$$V(D) = ts(\text{Min}\, D + \text{Max}\, D) * P1 + P2 + \cdots Pn-. \tag{5}$$

The remaining energy of all nodes supports maintaining the routing path as energetic for an extended time. The connection steadiness is reduced because the nodes get to minimize the failure path considering the velocity of the node; with the support of using these two constraints, tough and steady route is estimated for packet transmission. Depending

Step 1: multipath routing is established.
Step 2: for each to separate various paths in the network
Step 3: perform communication along multiple paths
Step 4: initiate packet transmission
Step 5: if {path distance==maximum}
Step 6: reject that path
Step 7: else
Step 8: if {path distance==minimum}
Step 9: select that path
Step 10: perform continuous packet sharing
Step 11: improve connection steadiness.
Step 12: end if
Step 13: end for

ALGORITHM 1: Algorithm for dispersed path selection for communication.

upon the residual energy of the node, the link steadiness and queue capability readiness of the node are altered. Output obtained from these various restrictions distinguished with the threshold level and considering the readiness of the node is altered. That restructured readiness is additionally applied for the path discovering procedure. Then, choosing the effective routing node, the connection steadiness of all paths is verified. It is based on the qualified movement of the nodes, and to evaluate it, the current connection steadiness is analyzed. In this analysis and dispersed path for multipath based on its performance, the high steadiness connectivity path is only chosen for packet transmission among source node and the target node.

$$V(D) = ts(\text{Min}\, DP1 + P2 + \cdots Pn + \text{Max}\, DP1 + P2 + \cdots Pn) - . \tag{6}$$

Whether the difference of the individual neighbor is lesser than the remaining neighbor nodes that are traveling along the network to communicate with an equivalent node, it should be said that these nodes continue simultaneously for the particular lifetime of the network. The intermediate node having few link differences is measured for path selection in the network. Communication might have different detail transmitted during the hello packet. It is obtained by counting one more field to the hello packet. Depending on this link difference, the additional steady node is chosen. The node contains a lesser link difference with the intermediate node forwarding the token just before the neighbor node. After accepting all packets, its steadiness value is improved. The more steady node that should be processed for the selected mobile node is the one that has a steadiness rate. the mobile node's remaining power, stability, and queue capacity. Depending on the entrance rate, the motivation of the node is altered. For every restriction, dissimilar threshold values are determined in Algorithm 1.

3.3. Multipath Jamming Detection Algorithm. Jamming occurs while nodes are involved by a single optimal path that guides the routing path to be deeply crammed. Subsequent to the transmitted packets reaching the target node, the target node creates a reply packet, which is sent through the packet received optimal path. The reply packets are transmitted on a similar route as that of their equivalent forward packets; it is sent in the reverse direction. Reply packets are revised in the routing table at relaying nodes for all the entries linked to the packets transmitted to the destination node in the network environment, or else, the sender node should initiate packet transmission to the connectivity steadiness routing path. The maximum connectivity steadiness nodes are chosen and then the maximum transmission rate in the routing table for the demand for the target node. $Ei - Ec$ is the initial energy and consumed energy.

$$Er = Ei - Ec-,$$

$$Mp = ts(\text{Min}\, DP1 + P2 + \cdots Pn + \text{Max}\, DP1 + P2 + \cdots Pn) * (Ei - Ec) - . \tag{7}$$

The jamming path is detected considering connectivity steadiness, while resource utilizes the maximum overall, and therefore, valuable details about the network condition are obtained by packets. To accept a request packet, all relay nodes are processed to achieve communication. The relaying node initially verifies if it is the target node itself otherwise not. It manages to jam and also needs to transmit the packet to the destination node in the network environment. A relay node only relays the data packets to the destination node, and the optimal path is chosen for communication among mobile nodes.

A multipath jamming detection algorithm is constructed in Algorithm 2, to obtain the optimal path with jamming-free routing between the source node and destination node in the network environment. The jamming paths are identified and removed from the network. It minimizes packet loss rate and energy consumption.

Packet ID: the packet ID contains every mobile node's communication details. The node location, node connectivity, and transmission rate of nodes are maintained in a specific routing table.

In Table 1, the proposed dispersed path selection for communication (DPAC) method packet format is shown. Here, the source and destination node ID field each carries

Step 1: sequentially transmitting data packets
Step 2: for each node, essential details are gathered in the routing table.
Step 3: if {packet ==jam}
Step 4: packets are blocked
Step 5: search for the optimal path for communication
Step 6: reduce packet loss rate
Step 7: else
Step 8: if {packet ==forward}
Step 9: that optimal path is chosen to perform communication
Step 10: minimize energy consumption
Step 11: end if
Step 12: end for

Algorithm 2: Algorithm for multipath jamming detection.

Table 1: Proposed DPAC packet format.

Source ID	Destination ID	Analyze distance for multipaths	Perform communication along multiple paths	Dispersed path selection for communication	Multi path jamming detection algorithm
3	3	4	3	3	2

3 bytes. The third one is to analyze the distance for multipath that occupies 4 bytes. The source needs to measure the distance for the routing path from starting point to the target node in a network. The fourth field takes 3 bytes. Perform communication along multiple paths, but it does not consider distance as the long or shortest distance. That path is used to perform communication with multiple paths. The fifth occupies 3 bytes, dispersed path selection for communication, monitors the entire communication, and then separates the routing path from multiple paths. The data packets are frequently transmitted; path is chosen, and then, estimate node transmission rate; the highest transmission rate node is selected. The multipath jamming detection algorithm occupies 2 bytes; this algorithm needs to detect packet jamming along the network routing path and also decrease packet loss rate and energy consumption.

4. Performance Evaluation

4.1. Simulation Model and Parameters. The proposed dispersed path selection for communication (DPAC) method is simulated with the network simulator tool (NS 2.34). In our simulation, 100 mobile nodes are placed in a 1038 meter × 1025 meter square region for 37 milliseconds of simulation time. Each mobile node goes random manner among the network at a different speed. All nodes have the same transmission range of 250 meters. In the context of telecommunications, the word "constant bit rate" (CBR) refers to the level of service. When compared to variable bitrate, constant bit rate encoding is the term used to describe the pace at which a codec's output data should be consumed. CBR (constant bit rate) provides a constant speed of packet transmission in the network to limit the traffic rate. For streaming multimedia files, CBR is helpful. A consistent bitrate of 300 kbps or less is preferable than one that varies throughout the transmission if the connection can only handle 320 kbps because the latter could exceed the limit. In order to achieve traffic-free routing, the DSDV (destination sequence distance vector) routing protocol is used. Table 2 shows the simulation setup estimation.

4.1.1. Simulation Result. Figure 2 shows that the proposed dispersed path selection for communication (DPAC) method is used to achieve an efficient and minimum distance routing path compared with existing ECC [19] and DCA [20]. DPAC technique is applied to measure the d distance of multiple paths from the source node to the destination node in the network. The various routing path transmission rates are estimated to choose the optimal routing path. The multipath jamming detection algorithm is designed to provide jamming-free packet transmission among the mobile nodes. This algorithm is used to reduce packet loss rate and energy consumption.

4.2. Performance Analysis. In simulation, analyze the following performance metrics using the X graph in ns2.34.

4.2.1. End-to-End Delay. Figure 3 shows that the end-to-end delay is estimated by the amount of time used for packet transmission from the source node to the destination node; multipath jamming detection algorithm is used to obtain packet jamming-free information sharing. In the proposed DPAC technique end to end, the delay is reduced compared to the existing scheme of ECC, EPATP, DCA, ERUP, and ISPA.

$$\text{End-to-end delay} = \text{end time} - \text{start time}. \tag{8}$$

4.2.2. Communication Overhead. Figure 4 shows that communication overhead is minimized in which the sender transmits the packet to the receiver node; multipath jamming detection algorithm is used to analyze the packet jammed in routing path reason with unstable node connectivity and maximum

Table 2: Simulation setup.

No. of nodes	100
Area size	1038 × 1025
Mac	802.11 g
Radio range	250 m
Simulation time	37 ms
Traffic source	CBR
Packet size	512 bytes
Mobility model	Random way point
Protocol	DSDV

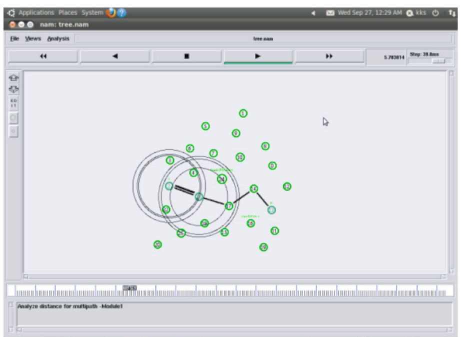

Figure 2: Proposed DPAC result.

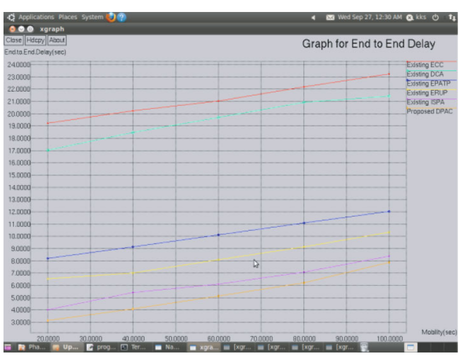

Figure 3: Graph for mobility vs. end-to-end delay.

distance path for packet transmission period. In the proposed DPAC technique, communication overhead is reduced compared to the existing scheme of ECC, EPATP, DCA, ERUP, and ISPA.

$$\text{Communication overhead} = \left(\text{number of packet}\,\frac{\text{losses}}{\text{received}}\right) * 100. \quad (9)$$

4.2.3. Throughput. Figure 5 shows that throughput is measured by received from the no. of the packet sent at a particular speed. Node velocity is not a constant, and simulation mobility is fixed at 100 bps. In the proposed DPAC technique, packet delivery ratio is improved compared to the existing scheme of ECC, EPATP, DCA, ERUP, and ISPA.

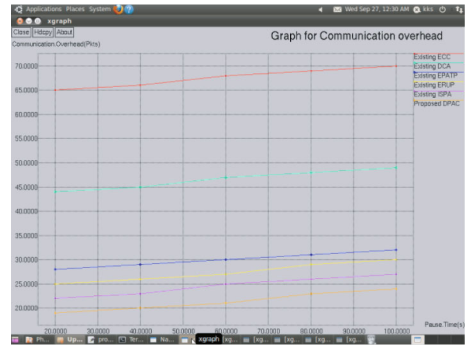

Figure 4: Graph for pause time vs. communication overhead.

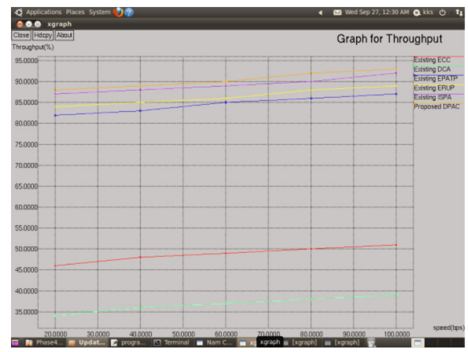

Figure 5: Graph for nodes vs. throughput.

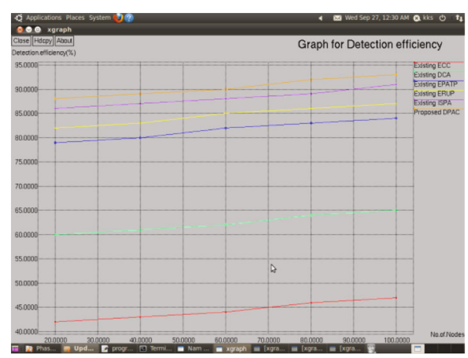

Figure 6: Graph for nodes vs. detection efficiency.

$$\text{Packet delivery ratio} = \left(\text{number of packet}\,\frac{\text{received}}{\text{Sent}}\right) * \text{speed}. \quad (10)$$

4.2.4. Detection Efficiency. Figure 6 illustrates the effectiveness of detection when attacks take place and packet transmission from source node to destination node is repeated. The multipath jamming detection algorithm is designed to identify the data packet jamming, and that path is rejected from routing. In the proposed ERUP DPAC technique detection efficiency is improved compared to the Existing scheme of ECC, EPATP, DCA, ERUP, and ISPA.

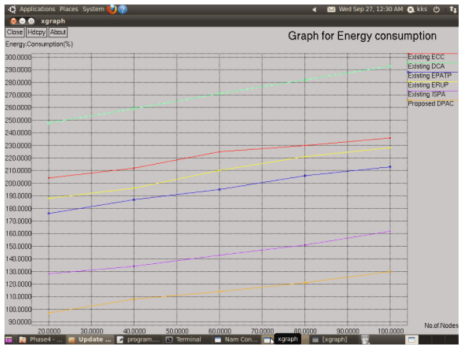

Figure 7: Graph for nodes vs. energy consumption.

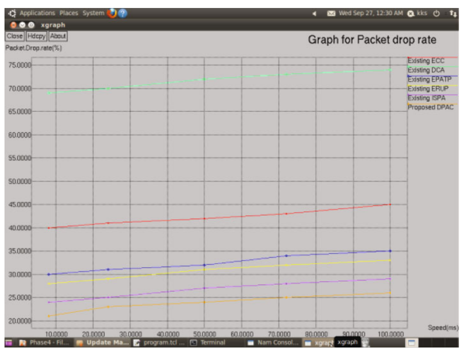

Figure 8: Graph for speed vs. packet drop rate.

$$\text{Detection efficiency} = \frac{\text{attack detection rate}}{\text{overall time}}. \tag{11}$$

4.2.5. Energy Consumption. Figure 7 shows that energy consumption is measured by the amount of energy spent on communication and the residual energy of network nodes. The designed multipath jamming detection algorithm is used to separate the optimal single path from multiple paths. In the proposed DPAC technique, energy consumption is reduced compared to the existing scheme of ECC, EPATP, DCA, ERUP, and ISPA.

$$\text{Energy consumption} = \text{initial residual energy} - \text{final residual energy}. \tag{12}$$

4.2.6. Packet Drop Rate. Figure 8 shows that packet loss of particular communication in the network is calculated by node loss packets with poor connectivity avoided by multipath jamming detection algorithm to reduce data jamming along the network node packet transmission. In the proposed DPAC technique, packet drop rate is minimized compared to the existing scheme of ECC, EPATP, DCA, ERUP, and ISPA.

$$\text{Packet drop rate} = \left(\text{number of packet} \frac{\text{dropped}}{\text{Sent}}\right) * 100. \tag{13}$$

5. Conclusion

MANET nodes are unsteady, it travels along the entire network environment. Single-path routing is not easy to achieve frequent communication. The weak connectivity of nodes makes the packet drop, and it makes packet overhead, because data are stored in a queue for long period. The resource utilization of the network indicates the transmission cost. Whether any packets are waiting in queue for a long time, the node energy is lost, so packets are lost. It improves packet loss rate and energy consumption. So, the proposed dispersed path selection for communication (DPAC) method is used to provide an efficient and minimum distance communication path; this path works with the support of queue storage, in which variation is managed the data packets storing; the time slot goes beyond its restriction level. Packets are reserved in the queue, to improve the packet sharing effectiveness. The multipath jamming detection algorithm is designed to achieve a connection-based path packet overload identification method to detect packet jamming. To control the overload, the path must also be divided based on its behaviour. It minimizes packet loss rate and energy consumption. The analysis of numerous parameters will be done in the future via adaptive cross-layer routing.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] "IETF MANET WG (mobile ad hoc network)," http://www.ieft.ora/html.charters/manet-charter.html.

[2] M. Ali, B. G. Stewart, A. Shahrabi, and A. Vallavaraj, "Congestion adaptive multipath routing for load balancing in mobile Ad hoc networks," in *2012 International Conference on Innovations in Information Technology (IIT)*, Abu Dhabi, United Arab Emirates, March 2012.

[3] C. Lochert, B. Scheuermann, and M. Mauve, "A survey on congestion control for mobile ad hoc networks," *Wireless Communications and Mobile Computing*, vol. 7, no. 5, p. 676, 2007.

[4] H. Cheng and J. Cao, "A design framework and taxonomy for hybrid routing protocols in mobile ad hoc networks," *IEEE Communications Surveys & Tutorials*, vol. 10, no. 3, pp. 62–73, 2008.

[5] M. Tarique, K. E. Tepe, S. Adibi, and S. Erfani, "Survey of multipath routing protocols for mobile ad hoc networks," *Journal of Network and Computer Applications*, vol. 32, no. 6, pp. 1125–1143, 2009.

[6] M. Gunes, U. Sorges, and I. Bouazizi, "ARA-the ant-colony based routing algorithm for MANETs," in *Proceedings. International Conference on Parallel Processing Workshop*, Vancouver, BC, Canada, August 2002.

[7] S. A. Alghamdi, "Load balancing ad hoc on-demand multipath distance vector (LBAOMDV) routing protocol," *EURASIP Journal on Wireless Communications and Networking*, vol. 2015, no. 1, Article ID 242, 2015.

[8] C. Kanani and A. Sinhal, "Ant colony optimization based modified AOMDV for multipath routing in MANET," *International Journal of Computer Applications*, vol. 82, no. 10, pp. 14–19, 2013.

[9] E. Selvi and M. S. S. Shashidara, "An efficient routing optimization using secure reverse multicast bellman ford ad-hoc routing using aomdv protocol in manet," *ARPN Journal of Engineering and Applied Sciences*, vol. 10, no. 9, 2015.

[10] M. Kaur and V. Chopra, "Implementation of rank based ACO approach with load balancing in ad hoc network for multipath routing mechanism," *International Journal of Computer Science & Engineering Technology (IJCSET)*, vol. 7, no. 6, 2016.

[11] S. V. Mallapur, S. R. Patil, and J. V. Agarkhed, "Load balancing technique for congestion control multipath routing in mobile ad hoc networks," in *TENCON 2015 - 2015 IEEE Region 10 Conference*, pp. 1–6, Macao, China, November 2015.

[12] M. Giacobbe, A. Celesti, M. Fazio, M. Villari, and A. Puliafito, "A sustainable energy-aware resource management strategy for IoT cloud federation," in *2015 IEEE International Symposium on Systems Engineering (ISSE)*, pp. 170–175, Rome, Italy, September 2015.

[13] D. Sunitha, A. Nagaraju, and G. Narsimha, "A cross-layer approach for congestion control in multi hop mobile ad hoc networks," in *2014 International Conference on Computing for Sustainable Global Development (INDIACom)*, pp. 54–60, New Delhi, India, March 2014.

[14] D. Nirupom, T. Komatsu, and S. Shiokawa, "Multi-path routing protocol considering inter-path interference in MANET environment," in *2012 18th Asia-Pacific Conference on Communications (APCC)*, pp. 858–863, Jeju, Korea (South), October 2012.

[15] J. D. Rekik, L. Baccouche, and H. B. Ghézala, "Load-balancing and energy aware routing protocol for real-time flows in mobile ad-hoc networks," in *2011 7th International Wireless Communications and Mobile Computing Conference*, pp. 343–348, Istanbul, Turkey, July 2011.

[16] P. Yang and B. Huang, "Multi-path routing protocol for mobile ad hoc network," in *2008 International Conference on Computer Science and Software Engineering*, vol. 4, pp. 1024–1027, Wuhan, China, December 2008.

[17] P. S. Hiremath, T. Anuradha, and P. Pattan, "Adaptive fuzzy inference system for detection and prevention of cooperative black hole attack in MANETs," in *2016 International Conference on Information Science (ICIS)*, pp. 245–251, Kochi, India, August 2016.

[18] G. Hu and C. Zhang, "MR-OLSR: a link state routing algorithm in multi-radio/multi-channel wireless mesh networks," in *2012 18th Asia-Pacific Conference on Communications (APCC)*, pp. 883–888, Jeju, Korea (South), October 2012.

[19] S. Rathore and M. R. Khan, "Enhance congestion control multipath routing with ANT optimization in mobile ad hoc network," in *2016 International Conference on ICT in Business Industry & Government (ICTBIG)*, pp. 1–7, Indore, India, November 2016.

[20] K. Zhou, C. Gong, N. Wu, and Z. Xu, "Distributed channel allocation and rate control for hybrid FSO/RF vehicular ad hoc networks," *Journal of Optical Communications and Networking*, vol. 9, no. 8, pp. 669–681, 2017.

[21] N. S. Kavitha, *Improved Sustainable Path Allocation Using Historical Backup For Node Interconnectivity Algorithm In Manet*, 2021.

[22] C. R. Rathish and A. Rajaram, "Hierarchical load balanced routing protocol for wireless sensor networks," *International Journal of Applied Engineering Research*, vol. 10, no. 7, pp. 16521–16534, 2015.

[23] D. N. V. S. L. S. Indira, R. K. Ganiya, P. A. Babu et al., "Improved artificial neural network with state order dataset estimation for brain cancer cell diagnosis," *BioMed Research International*, vol. 2022, Article ID 7799812, 10 pages, 2022.

[24] P. Ganesh, G. B. S. R. Naidu, K. Swaroopa et al., "Implementation of hidden node detection scheme for self-organization of data packet," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 1332373, 9 pages, 2022.

[25] M. Dinesh, C. Arvind, S. S. S. Mole et al., "An energy efficient architecture for furnace monitor and control in foundry based on Industry 4.0 using IoT," *Scientific Programming*, vol. 2022, Article ID 1128717, 8 pages, 2022.

[26] S. Kannan and A. Rajaram, "Enhanced stable path routing approach for improving packet delivery in MANET," *Journal of Computational and Theoretical Nanoscience*, vol. 14, no. 9, pp. 4545–4552, 2017.

[27] R. P. Prem Anand and A. Rajaram, "Effective timer count scheduling with spectator routing using stifle restriction algorithm in manet," *IOP Conference Series: Materials Science and Engineering*, vol. 994, no. 1, article 012031, 2022.

[28] C. R. Rathish and A. Rajaram, "Efficient path reassessment based on node probability in wireless sensor network," *International Journal of Control Theory and Applications*, vol. 34, no. 2016, pp. 817–832, 2016.

[29] K. V. Kumar and A. Rajaram, *Energy Efficient and Node Mobility Based Data Replication Algorithm for MANET*, 2019.

[30] C. R. Rathish and A. Rajaram, "Sweeping inclusive connectivity based routing in wireless sensor networks," *ARPN Journal of Engineering and Applied Sciences*, vol. 3, no. 5, pp. 1752–1760, 2018.

[31] K. Mahalakshmi, K. Kousalya, H. Shekhar et al., "Public auditing scheme for integrity verification in distributed cloud storage system," *Scientific Programming*, vol. 2021, Article ID 8533995, 5 pages, 2021.

[32] J. Divakaran, S. Malipatil, T. Zaid et al., "Technical study on 5G using soft computing methods," *Scientific Programming*, vol. 2022, Article ID 1570604, 7 pages, 2022.

[33] S. Shitharth, P. Meshram, P. R. Kshirsagar, H. Manoharan, V. Tirth, and V. P. Sundramurthy, "Impact of big data analysis on nanosensors for applied sciences using neural networks," *Journal of Nanomaterials*, vol. 2021, Article ID 4927607, 9 pages, 2021.