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Research Article

Implementation of Reliability Antecedent Forwarding Technique Using Straddling Path Recovery in Manet

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In a mobile ad hoc network, packets are lost by interference occurrence in the communication path because there is no backup information for the previous routing process. The communication failure is not efficiently identified. Node protection rate is reduced by the interference that occurs during communication time. So, the proposed reliability antecedent packet forwarding (RAF) technique is applied to approve the reliable routing from the source node to the destination node. The flooding nodes are avoided by this method; the previous routing information is backed up; this backup information is retrieved if any interference occurred in the communication period. To monitor the packet flow rate of every node, the straddling path recovery algorithm is designed to provide an interference free-routing path. This path has more number of nodes to proceed with communication. These nodes have a higher resource level and also used to back up the forwarded data; since sometimes routing breakdowns occurred, data are lost, which is overcome by using a backup process. It improves the network lifetime and reduces the packet loss rate.

1. Introduction

Various methodologies are mostly used and are extensive in both wired and wireless networks for enhancing the network performance and network quality of service. In the mobile ad hoc network structure, many hop routes may endure a high possibility of route damage considering irregular node velocity and frequent connection breakdown [1]. Dependability conservation in mobile ad hoc networks is an unwieldy process for the application layer depending on the service discovery method; for few commerce standard techniques, a service locality scheme can suitably set the very dynamic and decentralized context of mobile ad hoc network [2].

Cross-layer methods contain a long been explored to resolve the above issues, mostly effort to incorporate service detection with efficient communication techniques that are exclusively employed at network layers, that approach chiefly is used to attain the goal of exploiting purposeful similarity among these two types of techniques to recognize upgrade network characteristics among efficient recombination [3]. Considering the survey, the cross-layer service finding method is normally separate as spontaneous, practical, or hybrid based on which a kind of routing scheme is applied. Though various aims are placed in the cross-layer construction such as network efficiency, cost, and overhead minimization, little attempt is made for dependability improvement [4].

Trustworthiness-oriented and support route for energetic source routing scheme is used to obtain forceful and long-lived point-to-point links through mobile nodes in the network structure. It utilizes this communication scheme in a cross-layer method to maximally reduce network unsteadiness and connection susceptibility encountered chiefly by the wireless service finding process [5]. A correct route reliability calculation technique is initially obtainable where the stochastic property of residual connection or lifespan of the route is entirely surveyed. In particular, we define and prepare connection trustworthiness and route trustworthiness by explicitly taking into description node velocity metrics. Furthermore, connection through relaying nodes' connectivity is wholly measured in this scheme to reject packet loss in some established techniques [6]. Then, we suggest the routing process as modified by many routes, which permit each unbroken packet forwarding and quick path revival through trustworthy major and backup route choosing.

The analysis of a gradually more efficient method is used to execute multicasting in which a data packet is transmitted from a single node to a set of nodes in an ad hoc network structure [7]. The issue to solve in this process is the capability to obtain a steady route between the source node and many target nodes for sharing the data packets with the multicast transmission in the mobile ad hoc networks. If there are minimum steadiness paths between source and many target nodes, cluster packet transmission such as battleground packet sharing and adversity organization can lose the significant data which should certainly not get rebroadcasted [8]. If the allocation tree obliterates sequentially, considering the velocity of the mobile nodes and designing a recent allocation of path based on hierarchy, the path has maximum energy using; it is used to obtain a result which considers node velocity and reduce delay for the distribution hierarchy assembly commonly [9]. This reactive scheme evaluates the alternating paths for loop-free and area-disjoint routes. In this scheme, the routes are extra self-governing of each node, and the connection intrusion is minimum. It allows better traffic management in the network structure, and a main efficiency of the many routes as far as the characteristics analyzed as considered are disturbed [10].

The rest of the study is constructed as follows. Section 2 provides related works. Section 3 presents the information of the proposed reliability antecedent packet forwarding (RAF) technique to provide backup of the previous routing process. The straddling path recovery algorithm is designed to provide an interference free-routing path. Section 4 provides simulated performance results' analysis obtained under various metrics. At last, Section 5 concludes the study with future work.

2. Related Works

Wilson [11] regularly arrange contains interference node that is not willing to forward the packets but rather needs to forward their data. In specially appointed network throughput increments when every single accessible hub is utilized for directing and sending. So as opposed to keeping away interference nodes from the directing way the network can adequately use all the previous nodes. The self-centeredness of the node is considered and better security strategies are proposed to guarantee dependable conveyance of data. Reproduction demonstrates that the proposed framework guarantees less message overhead, memory, and time. Likewise, it endeavors to enhance throughput.

In [12], the proposed estimation dependably chooses the neighbor hubs that have the most noteworthy energy among all neighbor nodes. The moderate hubs are effectively debilitating their energy because of tolerating and sending information in the network. The proposed plot is used in these nodes' energy, by choosing them as indicated by staying the greatest energy level segment for using the vitality of hubs to improve the lifetime of the network. The sender has received the reply from each demand and chooses the staying most extreme energetic node for information transmitting. The proposed energetic proficient plan enhances the network performance in contrast with the typical minimum distance route. This routing process is assessed through execution measurements such as communication overhead and packet success rate.

In [13], multicasting is a basic approach that encourages loads of genuine applications, to accomplish group organization rather than exchanges between two nodes. To give an instructive outline of different quality of service based on the multicast way of discovering conventions proposed, an investigation is carried out in this process, alongside their operational highlights and points of interest. Execution examination given in their system engineering, quality-of-service parameters, attributes, and data utilized for directing is additionally introduced in forbidden shape with the goal that new scientists may effortlessly survey and take advantage of it in their exploration.

Mallapur and Patil [14] propose to construct a path steadiness given interest multipath steering convention for MANETs named as SBMRP (stable backbone-based multipath routing protocol) to enhance interface quality and to choose a steady way of the nodes. Proposed conspire incorporates a choice of applicant nodes and the development of directing spine to choose the steady ways between the source to the goal node. The proposed calculation has been checked by reproductions utilizing Network Simulator 2. The outcomes have demonstrated that the SBMRP improves the current routing process by altogether decreasing the course revelation and expanding group organization proportion and lifespan of nodes by building backbone routes among the source and the target node.

Abdulwahid and Guoxing [15] present an SLMR (scheduled links' multicast routing)-given velocity forecast. SLMR builds numerous allocated routes between multicast sources and target nodes. SLMR planned ways are liable to the efficient quality-of-service need to manage the traffic technique to minimize the energy usage impact caused by utilizing GPS (global position system) to anticipate portability parameters in the path designing process. During the course revelation process, different circle-free and node disjoint ways are developed for each source-target node. The enactment and deactivation of these routes are controlled by MRAT (multicast routing activation timer) and PTT (path timeout timer).

Basurra et al. [16] proposed an area-based routing protocol with parallel collision guidance broadcasting for the mobile network. The network is separated into adjoining areas led by the most solid and skilled nodes, called area establish, that are distinguished by an area development convention. Directing is set up utilizing another parallel crash direction broadcasting method which is started by the area established for routing inside and between areas. Through recreation, we exhibit that ZCG gives quick directing and a decrease in charge overheads in correlation with a run of the spontaneous communication technique.

Pavani and Sathyanarayana [17] propose a novel trust organization structure depends on the node characteristics, to conduct prediction calculations to save high network steadiness and security for the efficient packet transmission. This scheme is used to measure the characteristics of nodes and differentiate the faults and purposeful misbehaving nodes and evaluate a hub general protection rate. Exploratory outcomes demonstrate that the hub conduct expectation and trust administration framework enhances the throughput proportion and steadiness of the network.

Xiong et al. [18] introduce plan and execution problems of preemptive directing for multicast in a mobile network and point to a preemptive multicast directing convention given ODMRP (on-demand multicast routing protocol), in which PMR (preemptive multicast routing) appears. PMR altogether enhances the versatility of ODMRP; it offers comparable or higher packet success rate proportions while bringing about substantially less control overhead. Our reenactment has affirmed these merits of routing.

Rao et al. [19] present a plan of a reinforcement course foundation for quality-of-service directing convention. In this convention, the potential disappointments of the system and nodes are distinguished and reinforcement communication is started. For identification of failures, a path assessment work is resolved given the measurements of energy depletion rate and failure, and data blockage status is estimated. The essential way fulfilling the QoS parameter nodes' static asset limit, dynamic resource accessibility, neighborhood quality, and connection quality is built up. When disappointment is recognized, move-down paths are set up and transmission is diverted on these move-down courses. Re-enactment comes about to demonstrate that the proposed convention has a lesser delay and enhanced throughput.

In [20], mobile networks enable the nodes to send the information as packets using a predefined course. In the instance of disappointment with one select path, alternate paths must be accessible to proceed with the transmission. The option of the route to exchange the clusters is finished by utilizing steering conventions. Various directing conventions are generally utilized as a part of MANETs such as ad hoc on-demand distance vector routing, goal sequenced distance vector routing, dynamic source routing, and multipath source routing. In this process, we examine the different existing conventions and attempt to pick the best among them keeping in mind the end goal to accomplish the dependable and proficient transmission between two nodes in a network.

3. Overview of Proposed Scheme

In the mobile ad hoc network, data packets are lost by intrusion occurrence in the packet transmission path, since that data do not back up by the general routing process in a mobile network. The packet transmission breakdown occurred, and it is not resourcefully detected. The protection rate of every packet transmission is minimized by the intrusion that happened, during packet transmission period.

Consequently, the present reliability antecedent packet forwarding (RAF) method is used to support the efficient packet transmission from a sender node to the target node in the network environment. The attacker nodes are rejected by this RAF technique, the previous routing data are backed up, and backup details are retrieved if any intrusion occurred in packet transmission time instance. To observe the packet forwarding rate of every node in the network structure, the straddling path recovery algorithm is constructed to obtain a delay-free routing path. This path has more number of nodes to proceed with communication. These nodes contain the maximum capacity for the routing process and also use to back up the routing details, since sometimes routing failure is made, and the data are dropped and overcome by using the backup process. It increases the network lifespan and minimizes the packet drop rate.

Figure 1 shows the block diagram of the reliability antecedent packet forwarding (RAF) method. The mobile nodes proceed with the sequence of packet sharing from the sender node to the target node. Some interference causes communication failure. Reliability antecedent packet forwarding method is used to take the backup of routing information. Straddling path recovery algorithm is designed to choose the higher resource-level nodes for communication. This improves the network lifetime and minimizes the packet drop rate.

3.1. Sequence of Packet Transmission Is Made. In the wireless path, nodes are connected directly or indirectly with other nodes. Two stations such as source and destination can share data packets frequently if both nodes are blocked within the

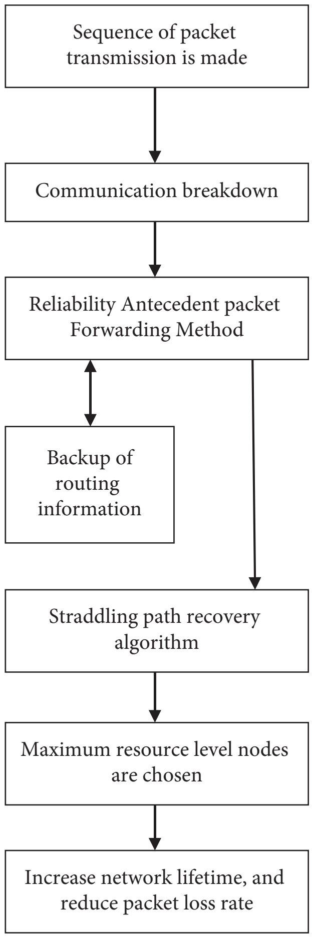

Figure 1: Block diagram of the reliability antecedent packet forwarding (RAF) method.

coverage range of remaining nodes in the network structure. No direct packet transmission is performed between the two sources and separate destination nodes. For unbeaten packet transmission process assembly, a routing path has to be recognized previously to the initial packet transmission assembly among the two stations through a few relaying nodes. Consequently, in this condition, interference is made at few of these relay nodes that can also be work nodes, some node source, and destination set, where If is interference routing, pf is reliability based, and Pr path recovery:

$$\text{If} = R\text{pf} + \text{Pr}. \tag{1}$$

Nodes perform packet transmission over duplex routes. A node should be energetic or inactive. An energetic node is prepared to forward data packets sequentially. The time gap between nodes is distinct when an energetic node completes the communication process; also, it is accepted at the relay node. A relay node is permitted to share data packets for its individual in a time gap. A relay node can share the amount of data packet specific time gap. The relay node needs to organize the data packets from the energetic nodes and share those data packets to the forwarding routes in the next time gap at a steady rate of packets' transmission during the on-time gap. This process is performed for a single packet for every time gap. Sufficient transmission rate is taken on many hop paths earlier than packet transmission start. The relay station is capable of primary storage bufmaintainainatin packet details, also for storing the acceptance packet from the energetic node in the path. $B(R)$ is backup routing, I is interfere, $P(c)$ is previous communication process:

$$\begin{aligned} R\text{pf} &= B(R) * I, \\ B(R) &= P(c). \end{aligned} \tag{2}$$

The communication interference is made in the relay node if many data packets are reached at the target node in the given time gap, and packet loss made with hence these packets are dropped. To estimate the packet drop, we consider interference at the obverse point relay node. The quantity of energetic nodes is considered to be a random variable with a regular rate as a time gap. The packet drop detail helps constructing the best technique for managing interference and, similarly, improving the storage space at relay nodes, improving the transmission rate of outgoing relay node connection, and minimizing the accepting forward of the packet at the relay node. $P(d2)$ are previous sharing data packets:

$$\begin{aligned} P(c) &= P(d1) + P(d2) + \cdots + P(dn), \\ P(c) &= \sum P(dn). \end{aligned} \tag{3}$$

The connection among the amount of the energetic nodes and packets is created for various rates. This information should be monitored when it improves the packet drop rate. This is suitable to the information that, while the output capability of the relay node to outgoing connectivity improves, it can contain the maximum amount of input energetic nodes, and the connection rate is minimized. The amount of data packets created improves as the amount of energetic node enhances at the contribution side of the relay node. Because the node is a loss broad-minded application, the accuracy estimated the packet drop rate is vital. Therefore, estimation of packet loss and packet latency can be maintained in the verification process, which discovers the correct control to the receiving data packet of the relay node. This should minimize the communication problems, packet latency, and jamming to the maximum degree. This can observe the overload at various rates.

3.2. Reliability Antecedent Packet Forwarding Method. An ad hoc network improves the entire network transmission rate by using all present nodes for communication. As an alternative to rejecting the intruder nodes in the network environment, we should make them successfully broadcast the data packet based on the scheme epidemic self-assured and designation self-assured. Nodes in the network are shared data packets by using a wireless structure. There are no nodes that can use its energy, wireless uptime, or maintenance for packet transmission for other nodes' information. However, they are involved to reside in the network environment to share packets for its packets. Therefore, they can be separated as interference nodes. To manage new nodes added, the network protection is launched. The routing protection can act as a guarantee and execute justification of interference nodes and identification of intruder nodes. The present method comprises mainly three parts: packet creation, broadcasting, and relaying process. $P(l)$ is packet loss:

$$B(R) = \sum P(dn),\\ I = P(l). \tag{4}$$

Packets' creation and transmission by nodes relay on the data packet by losing the data packets to every node in the network. This incur extra communication overload in the network environment. To be away from this issue, minimum distance path discovery scheme, this discovers an efficient route to the target node. Consequently, packet latency, data repetition, and memory space are less; they are overcome by using this reliability antecedent packet forwarding. In this scheme, the relay nodes have maximum memory space for the r routing process which is created by the target node to its prior intermediate node.

Verification process is performed only for the intermediate nodes in the minimum distance route. This verification can be done digitally by the target node. After accepting the signed data packet from the node, we must create evidence related to the target node and the evidence for accepting the data packet from the target node which is appended to its evidence. This is used and forwarded back to the source node; this information is backed up and maintained in memory of nodes which have a higher resource level. The evidence of the node provides a reply packet for the sender node, and it denotes the route from the source node to the target node. This obtains a guarantee that the packet reaches the target node among the approved nodes in the network environment. This process is to be validated by verifying the digital signs of the nodes in the routing list. This validation is performed in the communication processing part:

$$R\mathrm{pf} = \sum P(dn) * P(l). \tag{5}$$

Interference nodes always operate as packet loser to keep the information by using memory space. Except for a few nodes' loss of the data packets, they are short of memory space to buffer the information. These nodes do not consider interference nodes. Consequently, to identify the communication specifically, they propose a reliability on failure antecedent packet forwarding scheme which depends on confirmation of memory space. Every node has a memory space to maintain the data accepted. The data packet has a header part and message part. The header part keeps messages about the whole message duration, target node address, and source node address. If a node accepts a recent data packet and verifies its packet size with its available memory space and if the node has sufficient memory, it can accept it or lose the packet; they are stored in memory using this backup information and retrieved and forwarded to the target node without any loss (Algorithm 1).

3.3. Straddling Path Recovery Algorithm. The relaying node can promiscuously observe this packet loss e and the resource-level measurement by using the counter. If the countervalue is increased higher than a threshold value, then that node is an interference node. The nodes are losing the data packets because it does not have sufficient memory, and this can also be suitable for the breakdown in the network because the relaying node is not aware of the basis for packet losing. If the node is the guarantee node indicated to the neighbor node, the countervalue is lesser than a threshold value. $min(count)$ (minimum countervalue nodes) are

$$\mathrm{Pr} = \min(\mathrm{count}),\\ \mathrm{If} = \sum P(dn) * P(l) + \min(\mathrm{count}). \tag{6}$$

The nodes countervalue depends on the resource availability of each node. Memory space of node is with the original buffer size, when nodes are recorded in the network structure. If the countervalue is higher than the fixed threshold value, that node is interference; they are removed from the routing path. The lesser countervalue nodes are chosen to construct the interference free-routing path. This path is recovered by the RAF method in the network. It is called as straddling path recovery process (Algorithm 2).

Straddling path recovery algorithm is used to select the higher resource level and the guarantee node for the routing process. It improves the network lifetime and reduces packet loss rate.

Packet ID: packet ID contains every mobile node information. It also has the location of intermediate nodes.

In Figure 2, the proposed RAF packet format is shown. Here, the source and destination node ID fields occupy three bytes. The third one is a sequence of packet transmission is made which takes four bytes; this mobile node is used to proceed with continuous communication in wireless network. The fourth field occupies three bytes. The reliability antecedent packet forwarding method is used to provide a guarantee for packet transmission from the source node to target node. The fifth field occupies three bytes. Backup of routing information is used to take back up previous routing information by storing it in memory space of the node. The last field is straddling path recovery algorithm is used to choose the lesser countervalue node to improve network lifetime, and it occupies two bytes.

4. Performance Evaluation

4.1. Simulation Model and Parameters. The proposed RAF is simulated with the Network Simulator tool (NS 2.34). In our simulation, 100 mobile nodes move in an 855-meter × 656-meter square region for 36 milliseconds of simulation time. Each mobile node goes random manner among the network at different speeds. All nodes have the same transmission range of 250 meters. CBR (constant bit rate) provides a constant speed of packet transmission in the network to limit the traffic rate. AODV (ad hoc on-demand distance vector) routing protocol is used to provide an interference free-routing path. Table 1 shows the simulation setup is estimation.

Step 1: evaluate the memory size of every node
Step 2: for each node perform a sequence of routing
Step 3: sender initiates the communication process
Step 4: if{Path == Reliable}
Step 5: guarantee nodes are selected
Step 6: perform communication
Step 7: else if{Path! = Reliable}
Step 8: interference occurred
Step 9: the previous communication details are stored in node memory
Step 10: end the process

Algorithm 1: Algorithm for reliability antecedent packet-forwarding scheme.

Step 1: measure the every nodes resource level
Step 2: for each node design path based on countervalue
Step 3: if{counter value == high}
Step 4: that nodes are lesser resource node
Step 5: else if{counter value == low}
Step 6: that nodes are higher resource node.
Step 7: end if
Step 8: improve network lifetime
Step 9: end process

Algorithm 2: Straddling path recovery algorithm.

Source ID	Destination ID	Sequence of packet transmission is made	Reliability Antecedent packet Forwarding Method	Backup of routing information	Straddling path recovery algorithm
33	4	3	3	2	

Figure 2: Proposed RAF packet format.

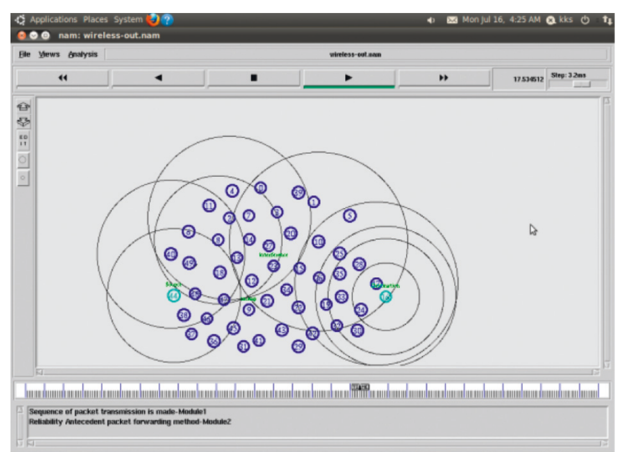

Figure 3: Proposed RAF result.

Table 1: Simulation setup.

No. of nodes	100
Area size	855×656
Mac	802.11 g
Radio range	250m
Simulation time	33 ms
Traffic source	CBR
Packet size	512 bytes
Mobility model	Random way point
Protocol	AODV

Simulation result: Figure 3 shows that the proposed reliability antecedent packet forwarding (RAF) method is used to provide interference free communication compared with existing ERE [19] and COR [20]. The RAF method is used to back up the previous routing information from mobile ad hoc network. Straddling path recovery algorithm is used to select the higher resource level and guarantee node for the routing process. It improves the network lifetime and reduces packet loss rate.

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

End-to-end delay: Figure 4 shows end-to-end delay is estimated by the amount of time used for packet transmission from the source node to the destination node; each node's details are maintained in the routing table. In the

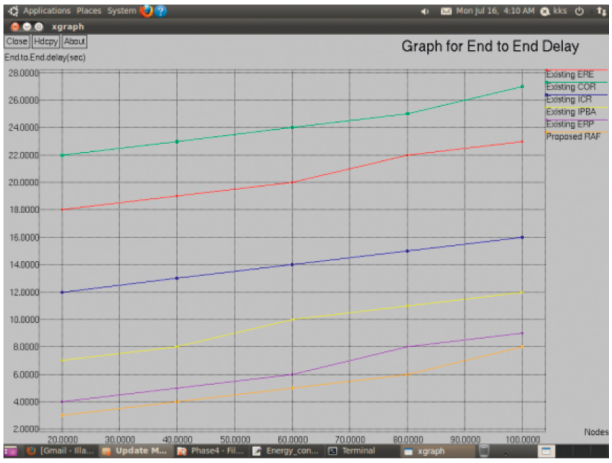

Figure 4: Graph for nodes vs. end-to-end delay.

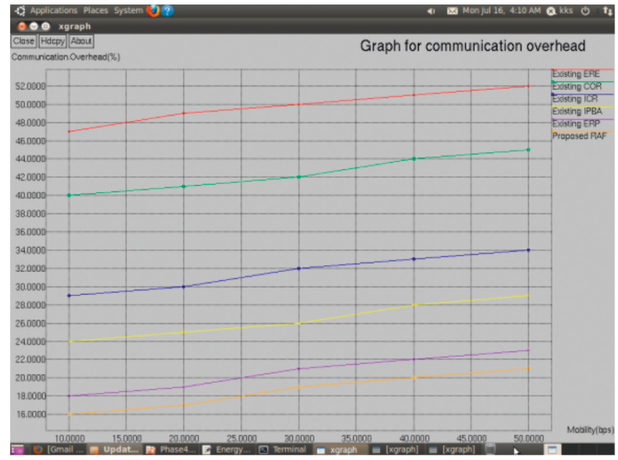

Figure 5: Graph for mobility vs. communication overhead.

proposed RAF method end to end, the delay is reduced compared to the existing methods, ERE, COR, ICR, IPBA, and ERP:

$$\text{End-to-end delay} = \text{end time–start time}. \quad (7)$$

Communication overhead: Figure 5 shows communication overhead is minimized in which sender transmits the packet to the receiver node. the reliability antecedent packet forwarding (RAF) method is used to back the previous routing information from mobile ad hoc network; this information is efficiently forwarded to the target node. In the proposed ERP method, communication overhead is decreased compared to the existing methods, ERE, COR, ICR, IPBA, and ERP:

$$\text{Communication}\ overhead = \left(\frac{\text{number of packet losses}}{\text{received}}\right) * 100. \quad (8)$$

Throughput: Figure 6 shows throughput is measured by dividing the number of packets received from the number of packets sent in a particular speed. Node velocity is not a constant; simulation mobility is fixed at 100(bps). Straddling path recovery algorithm is used to choose a lesser countervalue node for the routing process. In the proposed RAF method, the throughput rate is increased compared to the existing methods, ERE, COR, ICR, IPBA, and ERP:

$$Throughput = \left(\frac{\text{number of packets received}}{\text{sent}}\right) * \text{speed}. \quad (9)$$

Network lifetime: Figure 7 shows that the lifetime of the network is measured by nodes' process time which is taken to utilize the network from overall network ability. In the proposed RAF method, link connectivity is established, so network lifetime is improved compared to the existing methods, ERE, COR, ICR, IPBA, and ERP:

$$\text{Network}\ Lifetime = \frac{\text{time taken to utilize network}}{\text{overall ability}}. \quad (10)$$

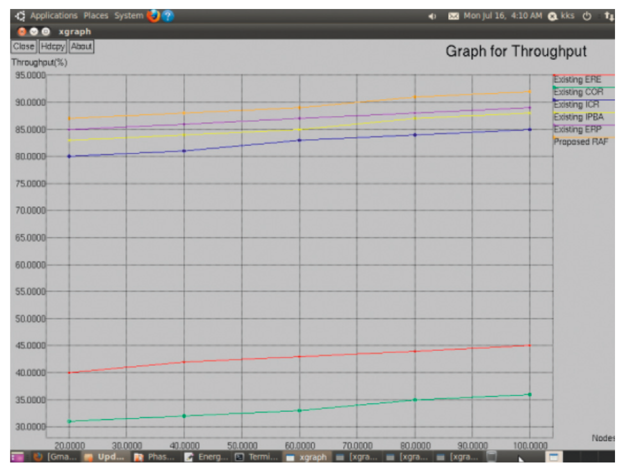

Figure 6: Graph for nodes vs. throughput.

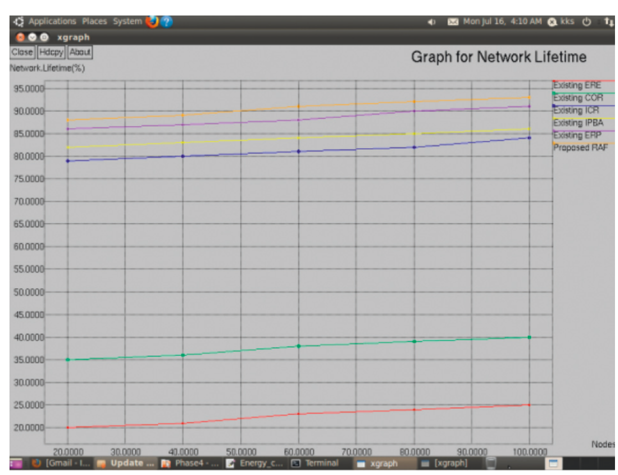

Figure 7: Graph for nodes vs. network lifetime.

Energy consumption: Figure 8 shows energy consumption and how extended energy spends on communication, which means estimating energy consumption from the starting energy level to the ending energy level. In the

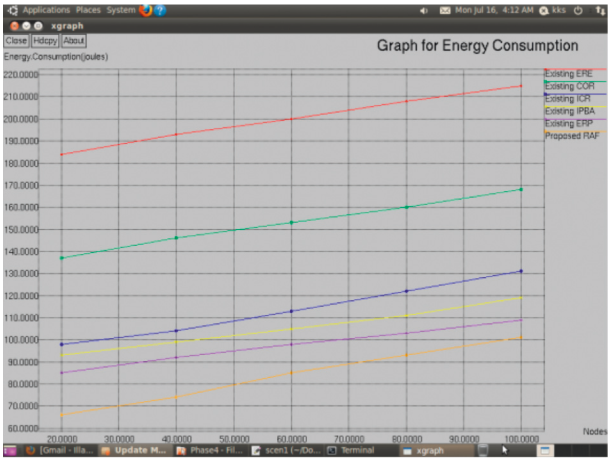

Figure 8: Graph for nodes vs. energy consumption.

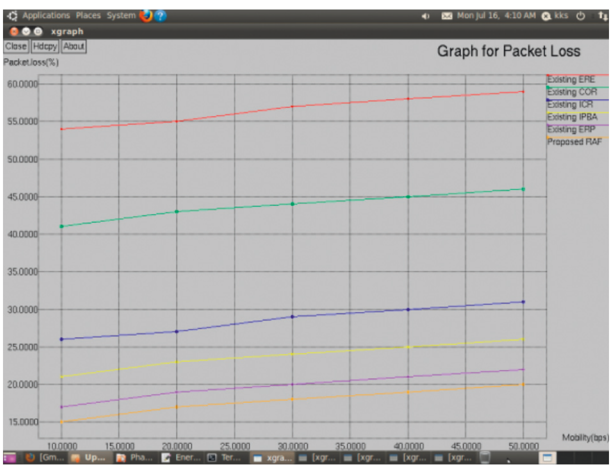

Figure 9: Graph for mobility vs. packet loss.

proposed RAF method, attack-free routing occurs in a movable network environment; energy consumption is minimized compared to the existing methods, ERE, COR, ICR, IPBA, and ERP:

$$\text{Energy consumption} = \text{initial}\, energy - \text{final energy}. \quad (11)$$

Packet loss: Figure 9 shows that packet loss of particular communication in the network is calculated by nodes' loss packet with weak connectivity to obtain traffic-free communication; the straddling path recovery algorithm is designed to select the maximum resource-level nodes. In the proposed RAF method, packet loss is minimized compared to the existing methods, ERE, COR, ICR, IPBA, and ERP:

$$\text{Packet}\, loss = \left(\text{number of packets} \frac{\text{dropped}}{\text{sent}}\right) * 100. \quad (12)$$

5. Conclusion

In a normal Mobile network, the node transmit packets are dropped by interference occurrence in communication path since there is no backup data for previous routing procedure. The node protection rate is minimized by the interference occurs during communication time. So, proposed reliability antecedent packet forwarding (RAF) technique is used to approve the reliable routing from the source node to the destination node. The flooding nodes are rejected by this method; the prior communication details are backed up, and if any abnormal situation of relay node gets failed to forward data, by using the backup procedure, that data are forwarded to the target node. The straddling path recovery algorithm is designed to select higher resource-level nodes, and it has a lesser countervalue. It improves the network lifetime and reduces packet loss rate. In future, dynamic abnormal behavior alteration scheme in mobile network will be used to measure different metrics.

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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