Energy Auditing and Broken Path Identification for Routing in Large-Scale Mobile Networks Using Machine Learning

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Received 27 May 2022; Revised 30 July 2022; Accepted 2 August 2022; Published 21 August 2022

Academic Editor: Mohammad Farukh Hashmi

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In mobile computing, all nodes are movable nodes, which causes many problems for transmitting data packets in a sequence manner; since the mobile nodes are connected with each other, during movement, nodes make the connection fail or damaged. This kind of link damage is caused by nodes that travel out of range from the network limit and also affect the packet success rate. This reduces the network lifetime and detection efficiency and increases the communication overhead. Every mobile node in mobile computing is an unstable node, causing numerous problems for broadcasting data packets in a series method. When the mobile nodes are connected to each other, relay nodes cause the link to break or else sustain damage. This type of connection failure is brought on by nodes that leave the network’s permitted range, which also lowers the packet success rate. The link failure cannot be recovered by the multipath routing algorithm. As a result, the communication overhead is increased while the network lifetime and detection effectiveness are reduced. Then, the novel energy routing (NER) method that has been proposed is employed to support the energetic routing path across the middle nodes. It is challenging to locate the failed channels and carry on with the successful packet transfer. The master node selection algorithm is intended to identify the best relaying node, fault-free packet transmission process among the network structure’s relaying nodes. The master node is efficiently chosen in this manner. The master node, also known as the energy-based important node, is employed in the mobile network to carry out error-free packet transmission procedures. The other nodes are lower energy nodes that do not participate in packet forwarding, and this algorithm only detects the higher energy successful nodes. This lengthens the network’s lifespan, improves detection effectiveness, and lowers communication overhead. The energy-based heavy node is also known as the master node, which is used to perform a problem-free communication process in the mobile network. This algorithm only accepts the higher energy successful node; the remaining nodes are lower energy nodes which do not perform the communication process. This increases the network lifetime and detection efficiency and reduces the communication overhead. The performance metrics for the proposed system is evaluated by end to end delay, communication overhead, throughput, detection efficiency, network lifetime, and packet drop rate.
1. Introduction

Because mobile nodes are connected to one another and their neighbors through links that can break when mobile nodes move, broadcasting data packets in mobile computing is severely hampered by the fact that all nodes are inherently unstable. Mobile nodes that move outside of the network’s permitted area cause this type of connection breakage, which also affects packet delivery. This reduces the network lifetime, increases the effectiveness of the detecting process, and enhances communication overhead. The proposed novel energetic routing (NER) approach is used to determine the length of the intermediary nodes’ energetic routing path.

Individually, the propagation of mobile nodes guides the improvement of the mobile ad hoc network structure. These networks have a set of wireless mobile nodes which are energetically sharing information between nodes, nodes without the dependence on any middle management or permanent sink node in the network environment. The self-organizing behavior permit mobile network is used to be without difficulty recognized in a wide variety of dissimilar conditions, like a release, urgent situation process, and battleground packet transmission [1]. Though, mobility and self-organizing characteristics of mobile network basis modify the topology in an irregular method. Most of the time, every mobile node with restricted communication needs to search for the support of its intermediate nodes for the packet-sharing process. As a simulation output, the characteristics of mobile ad hoc networks are mainly based on the trustworthy communication between mobile nodes [2].

Throughout the previous decade, a widespread survey can be performed on communication in mobile ad hoc networks, which should lead to various established routing techniques. Though, all these communication techniques are constructed with a statement so as to every node is entirely protected and agreeable to collaborate with the remaining nodes. Thus, they are susceptible to communication interference intruders which are not supportive, else break the rules for routing [3]. Regarding numerous types of communication interruption caused by intrusions, such as wormhole and black hole intrusion, which should be easily introduced in the mobile network, an energetic black hole intruder forever maintains that they contain the minimum distance route to the target node, yet they do not contain any suitable communication details [4]. This attacker is capable of silently stealing a large number of data packets. The attacker’s support for the packet has communication details, which are forwarded to the target node. Except to reject any data packets that are broadcast, H hole invaders can selectively disseminate these data packets rather than discarding all forwarding packets, which can increase their level of personal protection [5]. These hole intruders may alternatively perform better and worst. However, each black hole intruder and wormhole intruder must not give wrong data into the network; this only disturbs the communication process [6].

Low transmission rates and high packet latency are caused by mobile network characteristics including greater velocity and frequent link breakdowns. A guide to the requirements to provide the quality of services maintained is necessary given the high demand for mobile networks to transfer data packets. The performance of mobile networks such as their dynamic topology joined with the quality of the wireless communication intermediate makes worth service situations difficult problems [7]. The major intention of the quality of service is used to present better data delivery service for the uses that require it by ensuring enough transmission rate, selfish node cause delay, and smooth minimizing data drop. The problem to begin a link with the condition across many domains operated by the dissimilar node is a significant and difficult investigation [8].

In established routing, the major plan of the communication scheme is used to discover the minimum coast route from a sender node to a receiver node, while the quality of service-based routing has two goals. The initial objective is to identify the route that meets the known potential routes” quality of service requirements. The next aim is at providing the global network source consumption so that the network can control as many quality service request packets as possible [9]. The primary issue with obtaining the quality of service in the mobile network is that mobile ad hoc networks often have a maximum node speed, dispersed channel access, and limited signal intensity. This whole factor can be defeated with the assistance of various protocol layers to obtain the quality of service [10].

The residual of the paper is designed as follows. Section 2 provides related works. Section 3 presents the details of the proposed novel energetic routing (NER) method used to contribute to the energetic routing path along the intermediate nodes. The master node selection algorithm is planned to find out the optimal node and faultless packet transmission process among the relaying nodes. Section 4 provides simulation performance result analysis obtained under various metrics. In the last part, Section 5 concludes the paper with a future process.

2. Related Works

Cai et al. [11] present an evolutionary self-cooperative secure method that reproduces the communication process and relies on secure-level details to avoid different communication trouble by intruders. In this method, the mobile nodes can share data packets frequently in secured data packets and measure accepted secured data packets depending on their own cognitive measurement. Ultimately, every node energetically evolves its cognition to keep out misbehaving individuals. Generally, the smart feature of this evolutionary self-cooperative securing scheme is having internal intruders be familiar with the protection techniques operating, which does not negotiate with the network structure. Estimating the characteristics of this technique achieves better network scalability with the communication effectiveness over intruders in the mobile network.

Chrysikos et al. [12] present a framework that is the inherent path feature and propagation abnormality which diverge from unsophisticated route damage assumption like a free space model, else any comparable deterministic method which undervalues the alteration of the received
node energy level. It refers to a logically sound method for determining the wireless information-theoretical resolution’s trustworthiness in barrier-intensive topologies where no central communications survive as a result of a typical otherwise artificial failure and where harsh packet transmission sufferers and blast interfere with trust and reliable packet transmission. Thus, strong implementation of the basis of public protection is obtained.

The routing approach provided by Jain and Choorasiya [13] ensures that packet transmission in mobile ad hoc networks is more secure. It is important to investigate other methods that rely on secure schemes to safeguard mobile network operations from outside threats like DOS and black hole attacks. This scheme identifies a misbehaving node by evaluating the protection rate of the node of the mobile network. This technique transmits fake data packets made by the sender node to the target node. The difficulty is unavailable as, to expand an approach that is protected and improves the characteristics of the spontaneous communication procedure group.

The hope value updation strategy proposed by Kulkarni and Yuvaraju [14] was utilised for group head nodes that have trust value that is reorganised or re-energized for a gap in order to select the most recent cluster head nodes that are constantly moving. The efficiency of this algorithm in distinguishing the power-aware on-demand multicast routing (PAOMR) scheme is estimated in the experiment. The present method is compared with the existing method with lesser energy usage and obtains minimum packet latency.

Xia et al. [15] propose a narrative light-weight slanted trust-protected network structure, that is, separated into the protected evaluation and protected forecast. The communication of node protection assessment depends on the node’s historical characteristics. Then, utilize the achieved secure data series, to launch the weighted Markov stochastic sequence calculation to forecast node’s protection for the potential choice-obtaining process. Simulation is performed to measure the efficiency of the present protection model. In order to build four main enhancements that reflect on the problem of protection and present a novel protection-dependent communication method known as the on-demand protection-dependent multicast communication method, significant protection uses and depends on the model on-demand multicast routing technique.

Rao et al. [16] present to plan a reinforcement course foundation for the quality of service directing convention. In this convention, the potential disappointments of the system and hub are recognized and reinforcement directing is started. For identification of disappointments, a way assessment work is resolved in view of the measurements of the vitality depletion rate and obstruction and the blockage status is estimated. The essential way fulfilling the quality of the service parameters hub’s static asset limit, dynamic resource accessibility, neighborhood quality, and connection quality is built up. When disappointment is recognized, backup courses are built up and transmission is diverted on these backup courses. Recreation results demonstrate that the proposed convention has lessened recuperation delay and an enhanced transmission rate.

An enhanced method for anchored and solid correspondence in military-utilizing mobile networks is displayed in the work by Sivakami and Nawaz [17]. This work is towards enhancing the security of the message transmission among different courses by including the most dependable courses in the dynamic way which sets through the distinguishing proof and expulsion of Byzantine Faults. The course revelation process with the paired inquiry testing method is strong to Byzantine disappointments caused by individual or conniving hubs. Malignant connections are recognized, and these connections are then staying away by multiplicatively expanding their resource level.

Maekawa et al. [18] propose a communication scheme that utilizes unidirectional connections for building up ways to enhance the availability of systems and exploit the multi-path directing procedure. Notwithstanding, utilizing unidirectional connections presents new issues, for example, the location of connection detachment. Keeping in mind the end goal to take care of these issues, we propose three components: De-visiting around a unidirectional connection, recognizing joint disappointments by ants, and visually impaired retransmission. Reenactment tests demonstrated that the network expanded and a larger number of packets could be conveyed than AODV which did not utilize unidirectional connections.

Yoon et al. [19] propose two data-blocking versatile geocaching plans for strategic portable specially appointed systems. Our first plan is called “disappointment-based learning” in which the sender hubs do not know about the sticking assaults and endeavor to send packets over and over. This strategy is upgraded by another plan called “bypass by anchor point” with data about the sticking assault which is sent to the source hub, to such an extent that it can proactively maintain a strategic distance from the sticking locale for effective packet conveyance. The recreation results demonstrate that our proposed plots essentially beat single- and double-way geocaching conventions under sticking assault.

Heartbeat convention is presented by Scaglione et al. [20] along every way to ensure the convenient location of any single disappointment. We present an answer that can be actualized utilizing open-source programming and business off-the-rack equipment, which makes this methodology reasonable for systems with an extensive number of heterogeneous sensors. Results detailed in this paper demonstrate some example estimations and additionally the execution assessment for our pulse calculation as far as dormancy between a disappointment and a full recuperation of the framework.

In order to lessen MANET failure in the wireless network system, Idrees et al. [21] created the effective multipath routing and the glow warm detection. Thus, we know that the MANET used in the constant path and the energy conservation method helps to increase the stability function and the entire network performance better; thus, this proposed approach provides the enhanced accuracy.

3. Overview of Proposed Scheme

Every mobile node in mobile computing is an unstable node, which causes various problems for broadcasting data packets
in series. When the mobile nodes are connected to each other node, relay nodes cause the link to fail or otherwise cause damage. This kind of connection failure is caused by nodes, which travel out of range from network limitation and also affect the packet success rate. The multipath routing process must not recover the link failure. This minimizes the network lifetime and detection efficiency and improves the communication overhead [22–34].

Then, the proposed novel energetic routing (NER) method is used to contribute to the energetic routing path along the intermediate nodes. The failure paths are difficult to identify and continue the successful packet transmission. The master node selection algorithm is planned to find out the optimal node, faultless packet transmission process among the relaying nodes in the network structure. This way efficiently selects the master node. The energy-based important node is also known as the master node, which is used to perform trouble-free packet transmission procedures in the mobile network. This algorithm only recognizes the higher energy successful node; the remaining nodes are lesser energy nodes that do not perform the packet forwarding procedure. This increases the network lifetime and detection efficiency and reduces the communication overhead.

Figure 1 shows the proposed novel energetic routing (NER) method. Movable nodes travel in various directions along the network environment, with connectivity checking with every mobile node. The novel energetic routing (NER) method is used to contribute to the energetic routing path along the intermediate nodes. This avoids the damage path communication process. A master node selection algorithm is constructed to find out the optimal path. This algorithm only recognizes the higher energy successful node; the remaining nodes are lesser energy nodes that do not perform the packet forwarding procedure. This increases the network lifetime and detection efficiency and reduces the communication overhead.

3.1. Movable Nodes Travel in Various Directions. Mobile nodes move frequently, and using a transmission control scheme for mobile nodes raises a recent concern, the maximum energy usage for simultaneous utilization of multiple network interconnections. Meantime, the mobile nodes have very restricted energy levels considering the battery storage equipment. Regrettably, the baseline data transmission only is familiar with the link establishment of routes, and not its energy level; without considering the energy consumption of each route, it merely makes and completely leverages many network connections for simultaneous multipath communication. The sightless energy consumption in packet transmission can improve the energy usage of mobile nodes and reduce their network lifetime. In sequence to improving performance on a battery energy-level-restricted mobile node, it is essential to optimize the multipath consumption and construct a maximum-effect routing path, where Os is optimal node selection, Er is energetic routing, and Mn is the master node.

\[ Os = Er + Mn. \]  

\[ Er = Mt \ast sr. \]  

Figure 1: Block diagram of the novel energetic routing (NER) method.

In reality, as mobile nodes move around a lot, properly avoiding the consumption of low-performance routes and the following network connections may likely minimise the energy usage in the packet transmission. Despite the fact that the conventional transmission system only recognises routes that are either energetic or nonenergetic, it does not distinguish between these routes and, as a result, does not completely ignore the similar network connections for energy discounts. The aim of routing is used to optimize data transmission scheduling, and support data transmission is maximum energy efficient, by equally allowing for the transmission status and the energy price of every route. This prevents the routes with a probable failure status from also being utilised for data transmission in addition to the routes identified as not active, where Mt is the mobile node that travels and sr is stable routing.

This also processes data packets as efficiently as possible from a more energy-intensive route to a less-intensive one sequence to achieve the principle of energy reserves, in addition to muddling potential network connections failure for use of data transmission success ratio, and energy saving. The quantity of user data that can be offloaded to the energy-efficient route is based on every energy-efficient route. In movable node communication, it is previously recognized that all of the individual routes have their own routing to maximize the total count of the data packet, in which the sender node can allocate to it for jamming.
control, where \( T(n) \times C(n) \) is node travel and connection establishment and SnR is stable node routing.

\[
\begin{align*}
M_t &= T(n) \times C(n), \\
M_t &= n(T \times C).
\end{align*}
\]  

(3)

By equally allowing for combining the transmission status and energy level of every route, this routing can attain potential energy savings, while probably rejecting the happening of network traffic in multipath communications. Additionally, if all routes are flagged as connection failures, the sender node will use the route with the lowest energy range to increase the success rate of sending data. This operation can guarantee that routing obtains better energy savings and is distinguishable with each route within the network link that has probably failed.

3.2. Novel Energetic Routing (NER) Method. It has been suggested to use a novel energetic routing (NER) system that uses balanced energy usage to increase the lifespan of wireless sensor networks. Numerous cluster-based routing systems use various cluster creation approaches that result in energy loss. In the WSN, using the NER, the routes could result in an excessive energy decrease of nearby nodes (wireless sensor network). Here, we provide a method for saving energy during cluster creation and utilizing it for routing. A route under a connection failure can regularly communicate process time excess, and it is without difficulty to turn into a broken route. Throughout, this path organization is very straightforward and just inherits the transmission control protocol process for broken route identification. The intruded and failure route may still be measured as energetic in terms of performance, and it is used for data rebroadcasting while the transmission keep-alive time is still active. However, it takes quite some time to declare a failure route, which can lead to serious problems.

\[
\begin{align*}
M_t &= n1(T \times C) + n2(T \times C) + nn(T \times C), \\
M_t &= \sum n(T \times C).
\end{align*}
\]  

(4)

While a new data packet is assigned to a broken failure for forwarding, the sender node unavoidably executes redundant broadcasting through the failure route and performance communication. The communication disruption in the failure route can certainly involve the broadcasting efficiency of previous stable routes and corrupt the characteristics of the routing process. This can apply the maximum amount of retransmissions to observe the status of every route. The huge amount of broadcasting controls the count of times that a data section should be rebroadcasted by the sender node. Whether the retransmission counts on a route achieves the value of more data rebroadcasting; then, the maximum count of packet transmission alters the route to the motionless statuses. Though, the connection failure detection scheme is also called a solitary sample-based failure identification scheme.

\[
sr = SnR.
\]  

(5)

To improve the multipath communication process by identifying a failed path as quickly as possible and avoiding it from individual subsequent use, this communication process ending creates a route error count technique and a recent potentially broken status to the data transmission process. The design of a network in which the time instance among rebroadcasting is twice every time. Due to the exponential nature of the data transmission process, backoff techniques that increase the rebroadcasting time gap by twofold when one is introduced are motivated by these characteristics. As a result, the packet transmission is also improved by twofold even though the connection does not specify the amount of rebroadcasting.

\[
Er = \sum n(T \times C) \times SnR.
\]  

(6)

If the rebroadcasting timer is exceeded, fix the path and check to see if it records the path state as not energetic before

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**Algorithm 1:** For the novel energetic routing (NER) method.

- **Step 1:** Construct the manyroutes from source to destination node
- **Step 2:** For each node find neighbor node
- **Step 3:** Check the connectivity between nodes in the routing path
- **Step 4:** If \{ node == broadcast \}
- **Step 5:** stable path is discovered
- **Step 6:** elseif \{ node == rebroadcast \}
- **Step 7:** unstable path is discovered.
- **Step 8:** End if
- **Step 9:** End for

---

**Algorithm 2:** Master node selection algorithm.

- **Step 1:** monitor the node threshold level for failure rate.
- **Step 2:** for each node discover master node
- **Step 3:** if \{ failurethres == low \}
- **Step 4:** These nodes are stable link node
- **Step 5:** elseif \{ failurethres == high \}
- **Step 6:** These nodes are unstable link nodes.
- **Step 7:** End if
- **Step 8:** reduces communication overhead
- **Step 9:** End for.
ending the identifying system based on route failure counts. Therefore, the model route establishes the communication procedure, while the per significance on a path arrives at the value of maximum data rebroadcasting and the use of energetic node can base a route under failures, and permanent or explode time expires to finally arrive at the maximum data rebroadcasting rate. The route is denoted as a potentially broken down status. This does not use any potential failure route for use of data packet broadcasting; this only sends data packets to further identify the link establishment of the potential failure routes. This reduces the duration for route status identification and evolution, in addition to timely identifying dissimilarity per uninterrupted else error-free of the delay. The novel energetic routing (NER) method is used to contribute to the energetic routing path along the intermediate nodes. The failure paths are difficult to identify and continue the successful packet transmission.

3.3. Master Node Selection Algorithm. Selection algorithms select a coordinator process from a set of processors. A replacement coordinator is chosen on a different processor if the coordinator process crashes for any reason. In essence, the election process chooses where to restart a fresh instance of the coordinator.

Every active activity in the system is assumed to have a distinct priority number by the selection procedure. A new coordinator will be selected based on which process has the highest priority. This algorithm therefore chooses the active process with the highest priority number when a coordinator fails. The distributed system then sends this number to all running processes. The movable nodes are presented in the network, and breakdown occurs considering the velocity of the nodes. Beginning the group of relaying nodes, the individual can be selected on the origin of the breakdown rate and least processing time instance. The master node needs to fix the threshold value including two metrics, specifically, breakdown rate and higher processing time instance. The master node selects the nodes that are equivalent or have less values than the threshold to serve as relay nodes. In the master, the node has to set the threshold value of connection damage and greatest processing time instance. The node is chosen as a relaying node as its energetic rate is minimum than the threshold rate; correspondingly, this node is also chosen as a relay node, where Opn is optimal node selection.

\[
\text{Mn} = \text{Opn},
\]

\[
\text{Os} = \sum n(T \ast C) \ast \text{SnR} + \text{Opn}. 
\]

The selected relay nodes are currently starting to move forward with their communication by contributing a little quantity of packet transfer to the interior. When engaging in communication, if it departs from its starting point, there is a chance that it will break down at that point. To overcome this issue, a novel energetic routing method is proposed that defeats the failure problem considering the velocity of the nodes. The algorithm inserts new metrics to the active master node time which is the resulting time to avoid failure of communication.

The master node selection algorithm is constructed to detect the link failure node and also to select the master node, which performs energetic routing. This increases the network lifetime and detection efficiency and reduces the communication overhead.

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 Figure 2, the proposed novel energetic routing (NER) method packet format is shown. Here, the source and destination node ID field take two bytes each. Lastly, there are moving nodes that take up two bytes and move in different directions along the network, verifying connectivity with each mobile node. The fourth field takes four bytes. The novel energetic routing (NER) method is used to contribute to the energetic routing path along the intermediate nodes. This avoids the damage path communication process. Two

| Source ID | Destination ID | Movable nodes travels in various direction | Connectivity checking with every mobile nodes | Novel energetic routing method | Decisive connection identification algorithm |
|-----------|----------------|------------------------------------------|-----------------------------------------------|-------------------------------|---------------------------------------------|
| 3         | 3              | 2                                        | 4                                             | 2                             | 2                                           |

**Figure 2:** Proposed novel energetic routing (NER) method packet format.

**Table 1:** Simulation setup.

| No. of nodes | 100 |
|--------------|-----|
| Area size    | 1077 × 1065 |
| Mac          | 802.11 g |
| Radio range  | 250 m |
| Simulation time | 25 ms |
| Traffic source | CBR |
| Packet size  | 512 bytes |
| Mobility model | Random way point |
| Protocol     | DSDV |
bytes are used in the fifth. The last field takes two bytes, and the master node selection algorithm is constructed to find out the optimal path. This increases the network lifetime and detection efficiency and reduces the communication overhead.

4. Performance Evaluation

4.1. Simulation Model and Parameters. The novel energetic routing (NER) method is simulated with the network simulator tool (NS 2.34). In our simulation, 100 mobile nodes are placed in a 1077 meter × 1065 meter square region for 25 milliseconds of simulation time. Each mobile node goes in a random manner among the network at different speeds. All nodes have the same transmission range of 250 meters. The constant bit rate (CBR) provides a constant speed of packet transmission in the network to limit the traffic rate. The Destination sequence distance vector (DSDV) routing protocol is used to contribute to the energetic routing path along the intermediate nodes. Table 1 shows that the simulation setup is estimation.

4.1.1. Simulation Result. Figure 3 shows that the proposed novel energetic routing (NER) method is used to offer the energetic routing path along the intermediate nodes compared with existing SOL [35] and TES [36]. A master node selection algorithm is constructed to find out the optimal path. This algorithm only recognizes the higher energy successful node; the remaining nodes are lesser energy nodes that do not perform the packet forwarding procedure. This increases the network lifetime and detection efficiency and reduces the communication overhead.

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 4 shows that end-to-end delay is estimated by the amount of time used for packet transmission from the source node to the destination node. Giving one entity in a distributed system—a process, host,
thread, object, or human—special privileges are known as “electing a leader.” These unique abilities can include the capacity to delegate tasks, the capacity to alter data, or even the duty of managing all system requests.

A master node selection algorithm is built to identify the best path. Comparing the suggested NER approach to the existing ECAR, ERLN, NLEC, SOL, and TES schemes, end-to-end delay is reduced.

End – to – end delay = end time – start time. \( (8) \)

4.2.2. Communication Overhead. Figure 5 shows that communication overhead is minimized when the sender transmits the packet to the receiver node; the master node selection algorithm is constructed to find out the optimal path. In the proposed NER method, communication overhead is reduced compared to the existing schemes ECAR, ERLN, NLEC, SOL, and TES.

\[
\text{Communication over head} = \left( \frac{\text{number of packet losses}}{\text{received}} \right) \times 100.
\]  
\( (9) \)

4.2.3. Throughput. Figure 6 shows that throughput is measured by the number of packets received from the number of packets sent at a particular speed. Node velocity is not constant simulation mobility is fixed at 100 (bps).
Comparing the suggested NER method to the existing ECAR, ERLN, NLEC, SOL, and TES schemes, the packet delivery ratio is enhanced.

Throughput = \( \frac{\text{number of packets received}}{\text{sent}} \) * speed. \( (10) \)

4.2.4. Detection Efficiency. Figure 7 shows the detection efficiency; failures have occurred for efficient routing path based on local neighboring node allocation; the novel energetic routing (NER) method is used to obtain the stable routing path through relay nodes in the network. In the proposed NER method, detection efficiency is improved compared to the existing schemes ECAR, ERLN, NLEC, SOL, and TES.

\[ \text{Detection efficiency} = \frac{\text{attack detection rate}}{\text{overall time}} \]. \( (11) \)

4.2.5. Network Lifetime. Figure 8 shows that the lifetime of the network is measured by the node process and the time

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{network_lifetime.png}
\caption{Graph for network lifetime.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{packet_drop_rate.png}
\caption{Graph for packet drop rate.}
\end{figure}
taken to utilize the network from the overall network ability; the novel energetic routing (NER) method is used to offer the energetic routing path along the intermediate nodes. NER method’s suggested network has a longer lifetime than the existing ECAR, ERLN, NLEC, SOL, and TES schemes.

\[ \text{Network life time} = \frac{\text{time taken to utilize network}}{\text{overall ability}}. \quad (12) \]

4.2.6. Packet Drop Rate. Figure 9 illustrates how this new energy routing (NER) strategy overcomes the packet loss associated with link breakdown in the network for a specific communication. Comparing the new NER approach to the existing ECAR, ERLN, NLEC, SOL, and TES schemes, the rate of packet drops is lower.

\[ \text{Packet drop rate} = \left( \frac{\text{number of packet dropped}}{\text{sent}} \right) \times 100. \quad (13) \]

5. Conclusion

Because mobile nodes are connected to each other and their neighbours by links that can break when the mobile nodes move, broadcasting data packets presents many major problems in mobile computing. This type of link breakdown is made by mobile nodes, which move out of range from network area limitations and also have an effect on the packet delivery. This decreases the network lifetime, increases the effectiveness of the detection process, and reduces communication overhead. The proposed novel energetic routing (NER) method is applied to achieve the energetic routing path, the length of the intermediate nodes. The breakdown routes are simply detected and continue the failure-free packet transmission. The master node selection algorithm is designed to determine the optimal node and flawless packet communication between the relaying nodes in the network structure. This method selects the master node. The energy-based high-capacity node also known as the master node is used for proceeding with difficult free routing. This algorithm needs to permit the higher energy successful node; other nodes are lower energy nodes that must not proceed with routing. This increases the network lifespan and detection efficiency and minimizes the communication overhead. In future work use, an abnormal path-avoiding technique is applied to analyze various parameters.

Data Availability

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

Conflicts of Interest

There is no conflict of interest.

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