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Minimizing routing overhead using signal strength in multi-hop wireless network

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ABSTRACT

Constructing a stabilized route in dynamic topology and decentralized architecture is still an unsolved problem in mobile Ad-hoc networks. There are various research contributions where received signal strength has been used to enhance the routing performance. We reviewed the existing technique and found that adopting the current signal strength-based mechanism is not efficient enough to deal with overhead and energy consumption in mobile Ad-hoc networks (MANETs). The present manuscript introduces a novel routing schema called MROSS or minimizing routing overhead using signal strength (MROSS) that jointly addresses the problems of communication and network lifetime. The outcome of the study was developed using an analytical modeling approach to find MROSS significantly reduces routing overhead and energy consumption in comparison to existing routing techniques in mobile Ad-hoc network.

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1. INTRODUCTION

In a mobile ad-hoc network, the routing protocol is responsible for the communication model's successful operation. Defining routing protocols in dynamic topology, on the other hand, is never easy and necessitates a thorough understanding of their functions. In mobile ad-hoc networks (MANETs), routing protocols are divided into three categories: reactive, proactive, and hybrid. The self-configuring mobile nodes form the basis of the mobile ad-hoc network. It is characterized by decentralized mobile nodes with no infrastructure. Typically, mobile nodes are communication devices, such as smartphones, personal desktop assistance, tablet computers, and so on. In an ad-hoc network, a mobile node's physical location is constantly changing, causing the network topology to be more uncertain. The status of the link, as well as its connectivity with adjacent mobile nodes, changes as a result of the formation of dynamic topology. With each new or broken link, the mobile node must determine whether to conduct routing or to disconnect from the network. As a result, a number of researchers have proposed various routing protocols to deal with such issues and standardize traffic analysis in mobile ad-hoc networks. In mobile ad-hoc networks, there are three types of routing protocols: routing protocols might be reactive, proactive, or hybrid. The reactive routing protocol creates a routing table entirely on the fly, with no prior knowledge of the nodes. Ad-hoc on-demand distance vector (AODV) and dynamic source routing are two examples of reactive routing protocols. Before constructing routes, the proactive routing protocol will need to share the addresses of mobile nodes that will be entered into a routing table. Destination sequenced distance vector, optimized link state routing protocol, fisheye state routing, and other reactive routing protocols are examples. Hybrid routing protocols, such as zone routing protocol, combine the best features of proactive and reactive routing protocols. Mobile ad-hoc networks have a variety of uses, including crisis management, combat operations, defense, and military applications. According to the literature, many studies on mobile ad-hoc networks have focused on routing issues, energy issues, security issues, and so on. However, in mobile ad-hoc networks, the routing factor is responsible for the majority of the problems. As a result, it is completely understandable that there have been sufficient studies focused on routing issues for more than a decade. However, the routing problem remains unsolved. We describe a unique signal strength-based routing strategy that optimizes both overhead reduction and energy efficiency. Some of the novel features were introduced in this paper: i) despite using a traditional rectangular-based simulation approach, a new topology is constructed from communication districts and ii) the proposed study's innovative topology sources the query sent to the auxiliary node in an unusual way. The manuscript is organized: the previous work on signal strength in mobile ad-hoc networks is discussed in section 2, followed by problem identification in section 3. The proposed study's contribution is highlighted in section 4, which is followed by a discussion of research methodology in section 5. Section 6 discusses algorithm implementation, followed by section 7, which discusses result discussion, and section 8, which concludes with a summary of the paper.

2. BACKGROUND

This section discusses the most recent studies that have been presented by researchers. Despite the extensive literature on the use of signal strength to reduce routing overhead in mobile ad-hoc networks, there is still no specific focus on using signal strength to reduce routing overhead in mobile ad-hoc networks. In a Rayleigh fading environment, [1] present the operation of an adaptive hybrid direct-sequence/fast frequency hopping code-division multiple-access (DS=FFH-CDMA) study and evaluate its spectral efficiency in terms of theoretically achievable channel capacity. Abid *et al.* [2] have developed a routing technique for mobile ad-hoc networks that allows for efficient routing fine-tuning even in the most challenging conditions. To evaluate the level of tolerance in the presented cartographic technique of routing, the study used a random waypoint as the mobility model. Arunachalam and Sornil [3] are investigating the use and impact of random mobility models on route stability.

In mobile ad-hoc networks, the study looked into various flooding mechanisms and resource discovery techniques in peer-to-peer applications. The study's outcome was evaluated using network overhead, energy, delay, and query response time, which were all simulated in-network simulator-2. The study's findings were found to have superior performance in terms of bandwidth utilization and throughput. In order to minimize the overhearing process in mobile ad-hoc networks, the study [4] used received signal strength (RSS) to enhance the communication study in mobile ad-hoc networks. To normalize dynamic topology problems in mobile ad-hoc networks, the authors used RSS to forecast node mobility patterns. According to the study hypothesis, the higher the RSS value, the farther away the mobile node is. As a result, it may result in less stable routes. Data delivery ratio, delay, and energy dissipation were used to evaluate the study's outcome. Das and Tripathi [5], who used a sophisticated membership function to explore the best routing options in mobile ad-hoc networks, recently published an energy efficiency study. In addition to fuzzy logic, the study employs a variety of inference rules for route rating. The study takes a simulation-based approach, with the AODV routing technique being used to test the results in terms of throughput, data packet loss, and other factors.

Ravi and Jayanthi [6] looked into the energy efficiency issues in mobile ad-hoc networks. According to the study, the routing overhead in mobile ad-hoc networks has been reduced. The proposed study's results are compared to the commonly used AODV routing technique in terms of network lifetime and mean throughput. Sandeep and Kumar [7] recently completed a study in a similar direction. On various rounds of simulation, the study's outcome was evaluated in terms of packet delivery ratio. Sharmila and Sankaranarayanan [8] developed a method that emphasized efficient route discovery techniques using a flooding-based approach-simulated using OMNet++, an event-driven simulator, and random mobility. The study's findings were assessed in terms of route request success rates, request delays, and so on.

Khalid *et al.* [9] investigated energy consumption and routing issues in mobile ad-hoc networks in collaboration. As part of the solution, the authors have improved the traditional AODV technique. Khalid *et al.* [9] pursued a similar research direction to ensure energy efficiency in routing techniques for mobile ad-hoc networks. The authors have made a case against received signal strength indicator (RSSI), claiming that its numerical values may be flawed. As a result, this author does not recommend RSSI adoption. However, the authors presented a routing technique that takes into account the medium access control layer and the physical (PHY) layer to provide reliable routes while minimizing routing overhead. Throughput, network delay, and routing overhead were used to verify the study's findings. Wang *et al.* [10] investigated the use of RSSI to solve localization problems in an ad-hoc wireless sensor network. RSSI was used in recent work [11] to address localization issues. The link quality indicator is also improved as a result of the research. The use of RSSI, on the other hand, was not done to normalize traffic flow, but rather to improve unit route quality. Zhu and Alsharari [12], who have focused on developing a novel optimization technique, are working in a similar area. The authors created a one-of-a-kind transmission model that takes into account the shadowing effect. Debnath *et al.* [13] looked at how to reduce the shadowing effect in mobile ad-hoc networks. Gaur and Pant [14] used signal strength to provide security in their recent work. Peng *et al*. [15] conducted a study that used RSSI to assess the network lifetime of mobile ad-hoc networks. An interpolation technique was employed to extract more information from the signal strength. Errors in energy estimation were used to evaluate the study's outcome. The use of RSSI was also seen in [16] study, which used a threshold-based scheme. The authors employed signal strength to test mobile ad-hoc link quality. Tables 1 and 2 summarize the survey work done on routing overhead and signal strength.

Table 1. MANET routing overhead minimization work: a review

Reference number	Techniques	Routing protocol compared with	Inference
[17]	Flat Geographic routing	Proactive and reactive geographic routing	**Pros: significantly reduced routing overhead** **Cons: no evaluation of QoS parameters**
[18]	Adaptive cluster-based	AODV	**Pros: addresses issues with scalability.** **Cons: the energy efficiency has not been assessed.**
[19]	Neighbor coverage-based probabilistic rebroadcast (NCPR) protocol	-Nil-	**Pros: -Nil-** **Cons: no discussion of outcomes or scenarios for implementation**
[20]	NCPR protocol	-Nil-	**Pros**: -Nil- **Cons**: no discussion on outcomes & implementation scenarios
[21]	Probabilistic approach	AODV	**Pros: less computational complexity, less flooding overhead** **There is no mention of benchmarked results or algorithm efficiency.**
[22]	Investigational study on AODV and optimized link state routing protocol (OLSR)	AODV, OLSR	**Advantages: straightforward Approach** **Cons: not applicable to MANETs on a large scale.**
[23]	Rebroadcast technique	NCPR, AODV	**Advantages: NCPR was found to be superior to AODV.** **Cons: not applicable to MANETs on a large scale.**
[24]	Rebroadcast technique	AODV	Benefits: reduces network congestion and collisions. Cons: it does not address the issue of link failure.
[25]	Rebroadcast technique	NCPR, location-based routing (L.B.R)., AODV	**Pros: NCPR outperforms L.B.R. and AODV.** **Cons: there is no mention of energy efficiency, algorithm efficiency, or MANET reliability on a large scale.**

Table 2. Review of work done in MANET route optimization using signal strength

Reference number	Techniques	Routing protocol compared with	Inference
[26]	RSS	AODV	**Advantages: in total AODV is superior.** **Cons: benchmarking is less effective for proving reliability.**
[27]	Signal strength & energy awareness	Dynamic source routing (D.S.R), Signal stability based adaptive routing (S.S.A).	**Pros: D.S.R. is better than S.S.A. in terms of energy conservation.** **Cons: does not apply to large-scale MANETs, and algorithm efficiency is not addressed.**
[28]	Signal based geographic routing	Greedy perimeter stateless routing (GPSR)	**Advantages: enhanced security** **Cons: there is no effective benchmarking.**
[29]	Anti-localization anonymous routing based on signal strength	Epidemic routing, delivery ratio	**Advantages: provides anonymity** **Cons: quality of service (QoS) factors are not discussed, and algorithm efficiency is not discussed.**
[30]	RSSI	-Nil-	**Advantages: efficient bandwidth utilization** **Cons: there is no benchmarking.**
[31]	Signal based propagation model	Noisy shadowing model	**Pros: the VANET study's best works** **Cons: no evaluation of QoS parameters**
[32]	RSSI based congestion control scheme	-Nil-	**Pros: reduces traffic congestion for ITS.** **Cons: no extensive network evaluation, no effective benchmarking**

A closer look into the existing study shows that most of the studies carried out using RSSI are more or less focused on wireless sensor networks, where the problem of dynamic topology is not much adverse compared to mobile ad-hoc networks. Therefore, it was found that 85% of the research-based manuscript was found to use the RSSI concept more on wireless sensor networks and significantly less on mobile ad-hoc networks. It was found that 85% of the research-based manuscript used the RSSI idea more on wireless sensor networks and less on mobile ad-hoc networks. Hence, it was found that usage of RSSI towards minimizing the routing overhead is not addressed effectively. Very few studies are also found to address the effective non-RSSI-based technique in the use of routing performance.

3. THE PROBLEM

The dynamic topology of the MANET, as well as the resource constraint, are to blame for all of the MANET's problems. As a result of this problem, nodes frequently send control messages with excessive flooding (or overhead) in the network, resulting in MANET routing overhead. Better communication establishment in MANET necessitates the development of a novel routing protocol that can reduce MANET's control overhead. MANET frequently experiences intermittent link breakage as a result of this issue, which necessitates retransmission and adds to the routing protocol's overhead. This phenomenon has a significant negative impact on quality-of-service metrics such as (delay, throughput, and packet delivery ratio). As a result, the problem identified for the proposed study is minimizing control overhead in MANET without compromising the quality of potential routing behavior in MANET. The primary goal of the proposed research is to develop a framework for a novel routing protocol that will reduce the overhead caused by routing phenomena in MANETs with dynamic topologies. The contribution of the proposed study is highlighted in the next section, which is followed by a discussion of the research methodology.

4. PROPOSED SOLUTION

The proposed study aims to enhance the highest degree of dependability for carrying out data transmission in mobile ad-hoc networks with signal strength. Retention of a consistent route in mobile ad-hoc networks is one of the unsolved problems in research. The better possibility of filling the gap of the non-intermittent link is to explore the better condition of route stability that is essential for seamless communication in a mobile ad-hoc network. The primary objectives to be fulfilled to accomplish this goal are to ensure a selection process of a communication link with the highest degree of remnant battery. Fulfilling this objective will also ensure the generation of a route with a lesser probability of communication breakage. Hence, we name this routing technique as minimizing routing overhead using signal strength (MROSS) in the dynamic environment of mobile ad-hoc network as shown in Figure 1.

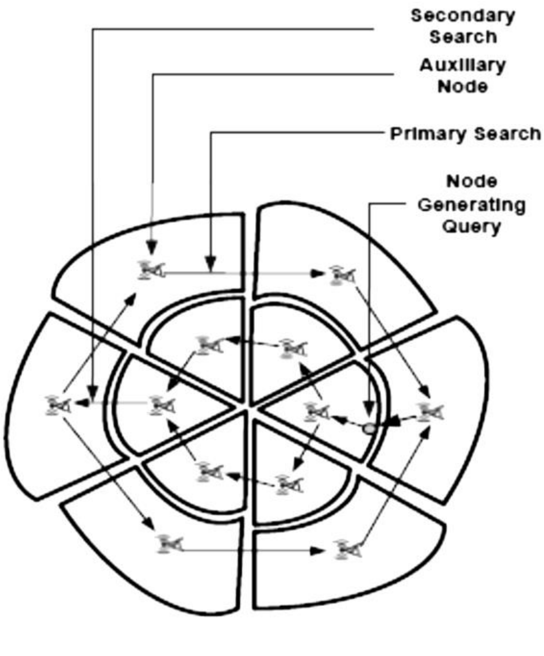

Figure 1. Search techniques in MROSS

The proposed system also introduces a unique network and communication model as shown in Figure 2. Network model is used for district construction as a part of contribution towards evolving up with a new topology while communication model offers a new role to be played by mobile nodes towards data transmission. The primary goal of this research is to present a novel routing framework technique that can reduce routing overhead with the help of increased signal strength, using the example of a mobile ad-hoc network as a case study. To address the challenges of mobile ad-hoc networks' dynamic topology, we propose an entirely new routing scenario in which traditional routing mechanisms are completely abandoned. The following are the main characteristics of this proposed study, as well as its novelty: i) to avoid routing overhead in mobile ad-hoc networks, create an entirely new routing protocol, ii) include a technique that maximizes data delivery while saving energy, and iii) create a function that balances data delivery speed and energy efficiency. The research methodology will be discussed in the section after that, which will go over the design techniques that were used to create the proposed study.

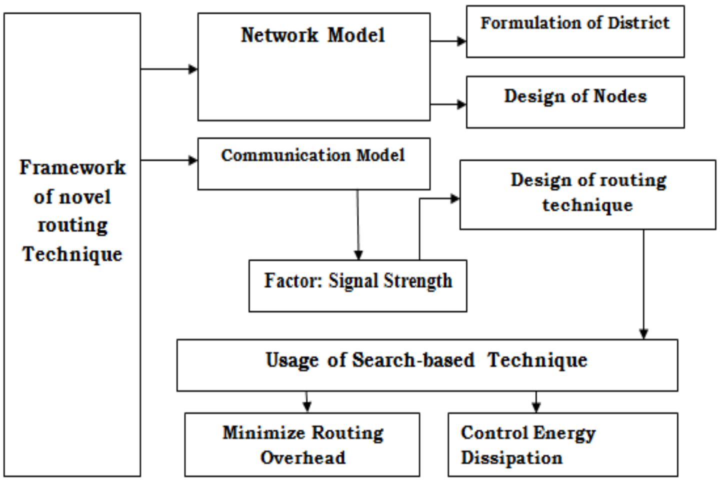

Figure 2. MROSS schematic diagram

5. RESEARCH METHOD

Analytical research methodology is used in the development of the proposed study. Figure 3 depicts the proposed novel idea's adopted schema. In a mobile ad-hoc network, mobile nodes are usually infrastructure-free, but we consider another type of node called an auxiliary node (AN). A, for example, does not participate in the data dissemination process. Nonetheless, they assist in routing decision-making by sharing signal strength information with the requesting mobile node. Unlike most studies, the proposed study does not take into account a typical cluster-based or group communication research study. Nonetheless, it believes that each mobile nodes are contained within a simulation area defined by a specific radius known as the communication district (CD). Every communication district is divided into smaller regions called sub-districts (SD) based on the number of chords intercepted in CD. The following sections discuss the modules' design mechanisms as well as their operations:

Formulation of district

The proposed method does not take into account a rectangular or squared-based simulation area, but it does take into account multiple overlapping communication zones of any shape, known as districts. Figure 3 depicts the flow of the district formation, which is accomplished by intercepting various chords on the simulation area in question based on intercepting angle (which is elliptical or circular different from conventional rectangular shape).

5.1. Design of nodes

In mobile ad-hoc networks, the proposed research looks at designing two types of nodes: mobile nodes and auxiliary nodes as shown in Figure 4. The mobile nodes function in the same way as regular nodes in terms of data dissemination and routing. The mobility of the mobile nodes is limited to the elliptical simulation area. As a result, the research considers the presence and mobility of mobile nodes within a defined map, i.e. districts and sub-districts, which are generated by mobile nodes based on their respective transmission range. It should be noted that the entire concept of the proposed system is based on a novel

MANET topology that governs the movement of mobile nodes in this area. The proposed method also includes the addition of an auxiliary node, which functions similarly to a relay node. However, we improve the concept by including new auxiliary node functionalities. AN is a special role played by a common mobile node in order to carry out data propagation, and it is chosen based on the availability of more resources within it. The design principle assumes that each SD contains at least one AN, implying that the number of AN is proportional to the number of SDs. It will be their sole responsibility to collect and disseminate signal strength information about any mobile nodes that pass through them. Because AN is a static node, we assume that it has no resource constraints (energy and memory).

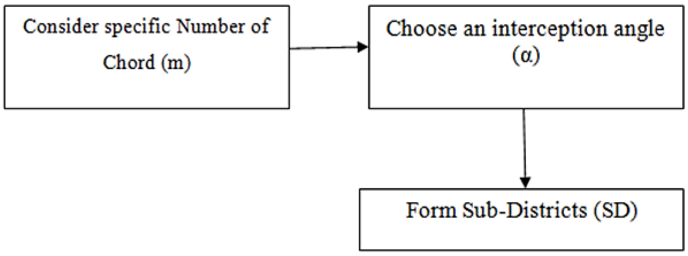

Figure 3. Formulation of communication district

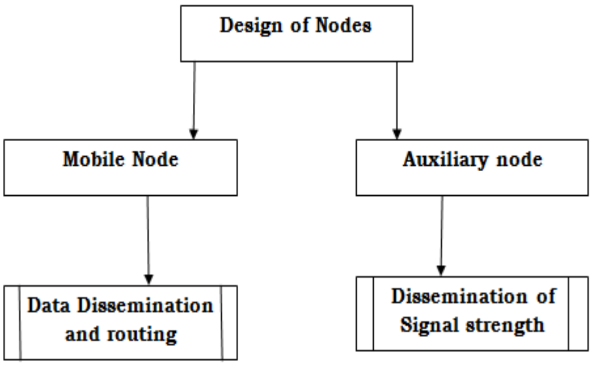

Figure 4. Design of nodes in proposed study

5.2. Design of routing technique

In Figure 5, The design of the proposed routing technique is highlighted. The routing operation begins with the generation of a query from any mobile node in the sub-district. SD when the mobile node query is sent to the auxiliary node, which forwards a bidirectional message requesting signal strength information, a primary search is started. Bi-directional messaging is a technique in which one auxiliary node in one SD broadcasts a single search beacon to another auxiliary node in another SD. When the higher signal strength is found, the search continues. When a search is terminated, two things happen: in the case of a close-end search, the AN with the assigned signal strength for the likely destination node is received. The requesting node develops a route with the newly discovered mobile node of matched signal strength, where the link stability is relatively high, based on the response. The routing technique, on the other hand, uses a perimetric search for an open-end search (due to dynamic topology, the previous AN could not find the matched signal strength). The source AN to another auxiliary node directing to the simulation area's perimeter formulates such a search. The destination node may move out during the search process due to random mobility, even though it is expected that 90% of the searches will be terminated in the primary search. As a result, secondary search aids in the capture of the mobile node with a specific signal strength. As a result, the secondary search will terminate 100% of the time, resulting in significantly less overhead.

5.3. Mitigating overhead and energy consumption

Due to the dynamic topology of the mobile ad-hoc network, mobile nodes usually have various energy-related issues on surfaces. Another fascinating aspect of the research is the use of bidirectional messages by the auxiliary nodes. Basically, bidirectional message is control message which are sent in two directions i.e. i) circular form connecting two auxiliary nodes in two different district and ii) linear form connecting two auxiliary nodes from center towards the periphery of total district. This inclusion does not induce any protocol overhead as it is sequential search process where either of the directionality search will eventually lead to successful transmission of data packet.

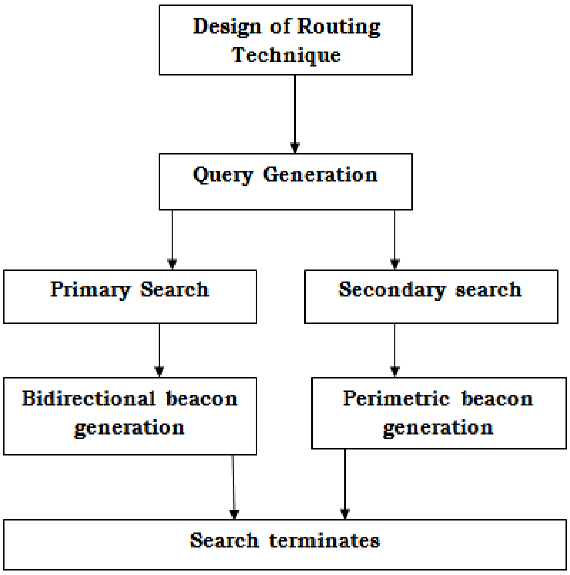

Figure 5. Design of proposed routing technique

However, after the search is completed, the study either finds a node that matches a query or continues with its secondary search. After passing to another auxiliary node, the routing information is updated in both cases, resulting in fresh routing message circulation and avoiding a collision. Because the entire routing operation takes place in real time, there is no way for unnecessary memory to accumulate, ensuring that a mobile node's energy and communication performance remains optimal. At any position of the destination node within a communication district, the proposed study ensures that the probability of data reaching the destination is exponentially high. However, in the preliminary search rounds, it may take some processing time. However, as the number of routing operations increases, the study collects more up-to-date information about the node's resource and signal strength status, increasing the likelihood of stable links in mobile ad-hoc networks, even in dynamic topologies. Another important point to remember is that messages for two different search types have different flags but the same fields and bit allocation. As a result, updating the routing message requires no memory, and this operation greatly aids in avoiding any routing overhead from one sub-district to the next.

6. ALGORITHM IMPLEMENTATION

The proposed design and developed algorithm are carried out using MATLAB on a study with windows OS and core i3 processors. The algorithm involves some of the simple calculations for developing elliptical network topology. The complete algorithm implementation of MROSS is shown as process flow in Figure 6. The initial phase of the algorithm starts with creating an elliptical shape network topology, which is constructed using MATLAB. We build sub-district (SD) and candidate districts making various such elliptical shapes of smaller size and get the interception points. The interception points are joined to formulate CD. We consider a presence of AN in one CD each in the proposed SD of MROSS. We also consider a dispersing n number of mobile nodes with a random waypoint mobility model within the proposed simulation area. A particular reference point is considered. For more straightforward computation, we consider the center of the ellipse as the reference point. A reference point is just one reference location from which the proposed study carries out the distance-based calculation. It should be noted that this is just an initial position to initiate transmission; however, any node in any part of network can formulate query and propagate them in decentralized mode. The study could also consider the nearest node a reference node and thereby communicate with various districts. This algorithm is mainly executed within AN.

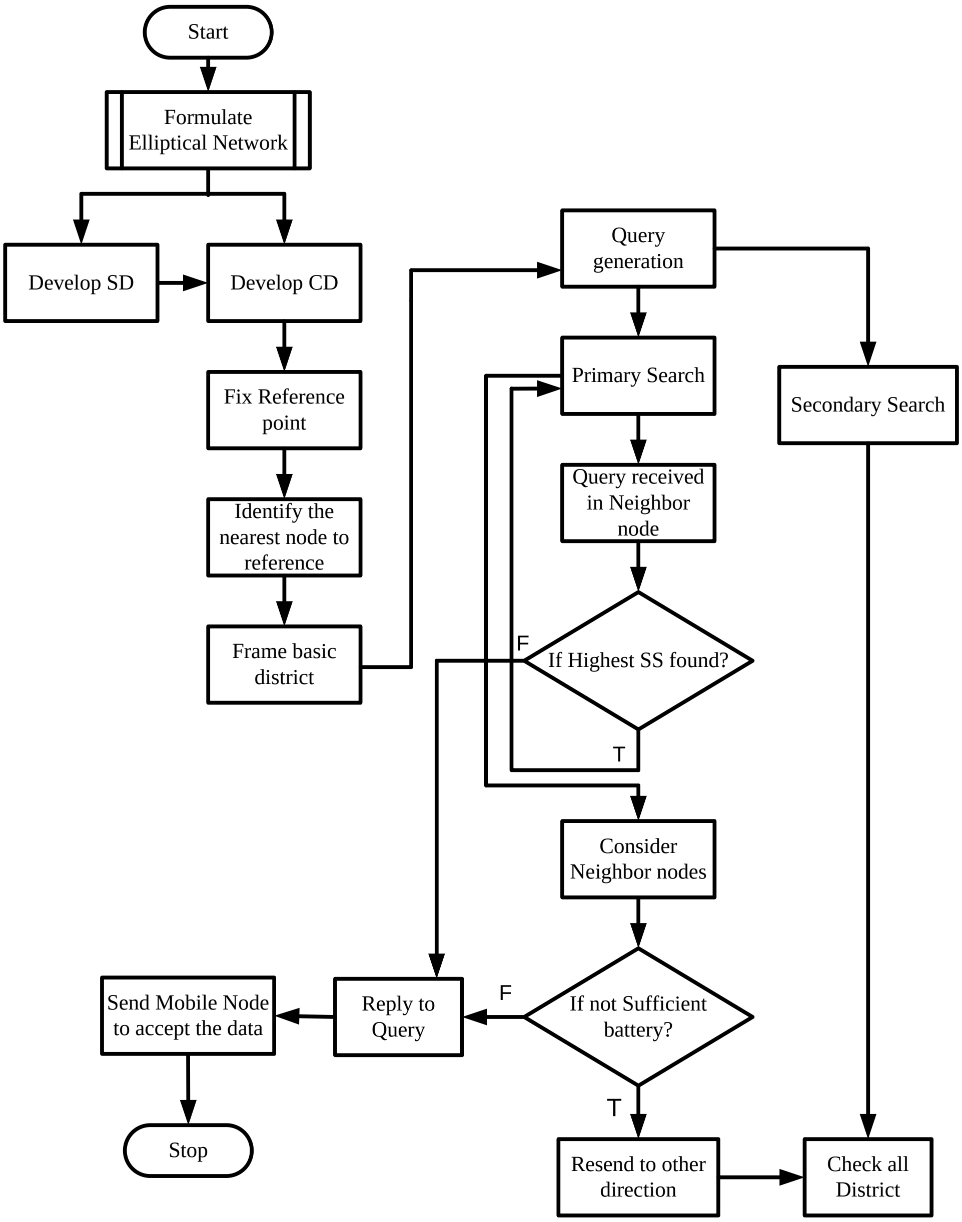

Figure 6. Implementation of MROSS

We consider that there is one source node that is interested in performing communication with another node. Hence, the proposed study aims to perform communication only through the highly stabilized link. We associate the term stability with a link formulated by the nodes with the highest residual energy and maximum signal strength at the same time. Hence, a query message is generated, which is instantly passed on to the nearest AN. After receiving the request message, the AN starts a bidirectional search for the nodes with maximum signal strength. As one AN has resource information about the mobile nodes in its CD, AN will always attempt to check for nodes in its CD first. However, this search will result in the possibility of a mobile node with more signal strength. Hence, it progresses its search vectors until it converges to one AN in the same CD rows. This is called a primary search. The possibility of the primary search is two, i.e.: i) it may either find the node with the highest signal strength and ii) it may fail in its search. In a positive outcome, the last AN forward the response message to the requesting node to consider the explored mobile node. It is a neighbor node. However, in adverse search outcomes, the search space is incremented to the next level of candidate district, called secondary search. In secondary search, the AN node, instead of searching in a bidirectional way, initiates a perimetric search, which means searching for the mobile node with maximum signal strength towards the ellipse’s perimeter. Due to dynamic mobility, there is always a possibility that the destination node may move out, resulting in adverse search outcomes. Therefore, although primary search can yield a 90% of success rate in finding the destination node, in case of failure, 10% of the rest success rate is assured by secondary search technique even if the source node itself moves from its original location.

The algorithm of MROSS initiates by taking an input of surface of elliptical region (S), chord (c), sub-district (S_D), candidate district (C_D), mobile nodes (n), source node (n_s), and destination node (n_d). The first part of the algorithm formulates developing the elliptical shape and the usage of chords to give the shape of the elliptical topology. The formation of SD and CD can be seen in Figure 7, which will mean that the total number of SD will mean a communication area formed by the interception of two chords within an ellipse. It will also mean that keeping the reference point as the center of an ellipse, the interception of two chords through the reference point will generate two sub-districts eventually (line-2-3). However, the generation of sub-district does not mean the generation of candidate districts. We generate candidate districts by making more overlapping ellipses with bigger or smaller perimetric sizes defined by a scale factor (line-4).

MROSS algorithm design

```
Input: S (surface of Elliptical Region), c (chord), S_D (Sub-district), C_D (Candidate
District), n (mobile nodes), n_s(source node), n_d (destination node)
Output: Route establishment
Start
1. Init S, c
2. Evaluate x=interceptReg(c, S)
3. Assign x→S_D
4. x_1→scale(x)
5. Assign x_1→C_D
6. Allocate single AN in one C_D.
7. random dis(n) in all S_D
8. n_s→query(req_SS)→(AN)C_D
9. for all AN in 1^st C_D
10.   AN→fwd_query(bidirectional_search)
11.   get(n_d)
12. or else
13.   AN→fwd_query(+/-perimetric_search)
14.   get(n_d)→n_s→n_s(route_est)n_d.
End
```

The algorithm then randomly selects any mobile node for query generation and resides on any candidate district (line-5). The query message generated by the source node ns is passed on to AN residing in the same CD (line-8). The AN then initiates its bidirectional search by forwarding the query message in both directions of the adjacent candidate node until it finds a mobile node with maximum signal strength (S.S.). If the mobile node with the highest S.S. is present in one or its corresponding CD, the respective AN forward the response to the source node about the identity, position, and residual information of that node. It is then the sole decision of the source node if it would like to perform routing or not. However, it saves a considerable amount of computational processing for exploring the best path to perform the routing in case of the dynamicity of the nodes. However, in a negative outcome of the primary search (line-10), the last AN start progressing towards a new AN residing in another CD in perimetric order. An interesting observation is that such searching for the route is required only once to explore and once to update for multiple communication that significantly saves a massive amount of energy even in peak traffic conditions.

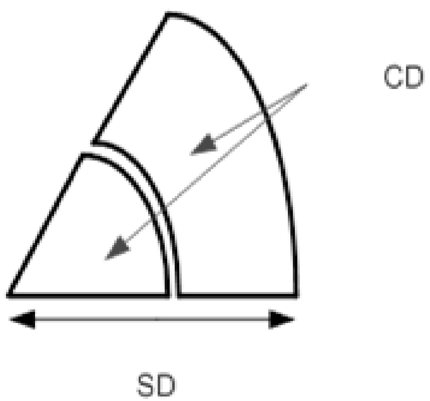

Figure 7. Understanding SD and CD formation

7. RESULTS AND DISCUSSION

This section presents discussion of the outcomes obtained from simulation study considering following simulation parameters viz. i) 500 mobiles nodes, ii) transmission area of 10 meters, iii) simulation area of 1100x1200 m^2, iv) min energy to initialized 3 J and maximum energy of 10 J, v) simulation iteration of 1000. With increasing simulation rounds, the results of the proposed routing technique were compared to those of the traditional routing techniques of AODV and destination sequenced distance vector (DSDV) in terms of performance parameters such as routing overhead as shown in Figure 8, packet delivery ratio as shown in Figure 9, and energy consumption as shown in Figure 10.

7.1. Analysis of routing overhead

Routing overhead is defined as cumulative data packets evaluated once per hop. can quickly occur for any mobile node due to the maximum retransmission level in the mobile ad-hoc network. Conventionally, routing overhead increases with an increase in simulation rounds as nodes drain energy, resulting in intermittent links. Due to intermittent connections, established routes break that provoke the source node to perform retransmission, causing significant routing overhead. Hence, routing overhead is strongly associated with energy drainage too. When compared to AODV and DSDV, the result in Figure 8 clearly shows that the proposed study has a 40% reduction in routing overhead. Existing routing techniques begin with the traditional route discovery process, which is the root cause of this result. The research considers building a route that will be maintained node-to-node. The existing study uses a group or cluster-based concept for larger areas, with the cluster leader performing and assisting the routing. Our proposed method, on the other hand, is devoid of any defined groups and is based on the novel concept of a communication district. Furthermore, the research does not take into account any state routing information that occurs in AODV. Even in the presence of dynamic topology, the study does not require the extraction of any identity-based information that occurs in DSDV, resulting in faster route generation.

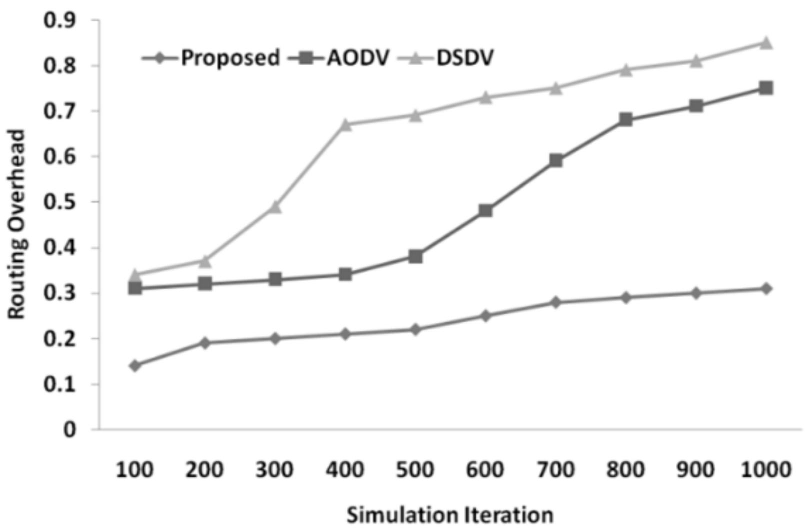

Figure 8. Routing overhead

7.2. Analysis of energy consumption

For energy calculation, proposed system configures the mobile nodes with an initialized energy of 3 J with a maximum of 10 J till the node is dead. A specific allocation of energy per data is carried out for each node to observe the level of energy being consumed. Another important performance parameter that costs the overhead among the mobile nodes in the ad-hoc network is energy consumption. The result of Figure 9 highlights the energy factor’s performance across the studies. As a result, AN result manages the entire route construction and maintenance process. Only signal strength information is used to complete the routing assistance, resulting in route selection. The auxiliary node selects the appropriate intermediate node based on signal strength at the time, depending on the type of query message. If no new nodes join the network during the simulation, a simple search-based technique ensures data delivery to the destination node. The idea of selecting and building routes based on signal strength is a novel one that is also very cost-effective.

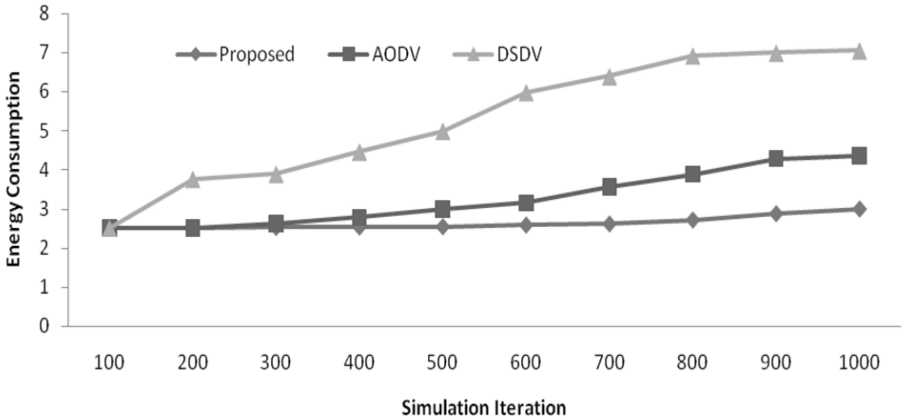

Figure 9. Energy consumption

7.3. Analysis of packet delivery ratio

The packet delivery ratio is calculated by dividing the total number of data packets transmitted by the total number of packets received at the destination node. Calculating the packet delivery ratio is the best way to understand the reduction in routing overhead. The result in Figure 10 shows a significant increase in data transmission, as measured by the packet delivery ratio. Gradient descent for packet delivery is due to decreasing energy as the number of simulation rounds increases. The results of the curve also show that the proposed study's packet delivery ratio outperforms the existing AODV and DSDV routing techniques.

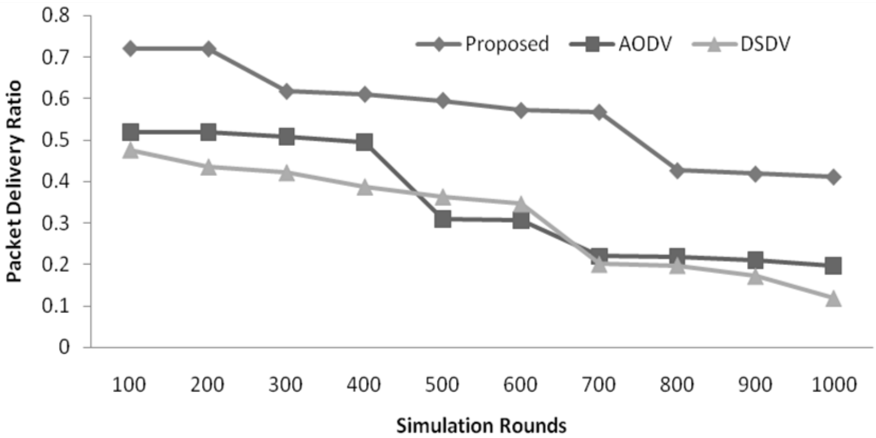

Figure 10. Packet delivery ratios

8. CONCLUSION

In mobile ad-hoc networks, routing has always been the most difficult problem to solve. Despite the fact that massive archives and volumes of research manuscripts have been discovered to solve the problems of energy, routing, security, and so on, none of these problems have been completely solved to date. This paper highlights a problem that has been completely overlooked in previous research, namely, jointly addressing routing overhead issues and enhancing energy conservation in the presence of dynamic topology in mobile ad-hoc networks using improved signal strength. The entire interaction mechanism between mobile nodes and auxiliary nodes ensures the lowest routing overhead, which controls energy dissipation in the mobile ad-hoc network indirectly. The study’s findings were compared to the most commonly used reactive and proactive routing techniques using performance parameters such as routing overhead, packet delivery ratio, and energy consumption. The proposed study’s analysis ignores the impact of various types of interference because the goal is to develop a novel routing scheme rather than studying various factors that affect data quality. For the same reason, the study does not look into handover delays. Our future work will focus on further optimizing the method to ensure that more energy is retained.

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