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Energy Efficient Routing based on Reliability for Mobile Ad hoc Network

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Abstract*: *MANETs is a network which has nodes. Communication is done without use of infrastructure. Quality based routing is developed which considers end to end qualitatiove data communication. A number of protocols were designed and suggested by researchers to achieve effective communication in MANETs. Considering number of quality factors as energy, trust, bandwidth etc a number of protocols are existing. But still there are number of factors those can consider to enhance the performance of the protocols used for the communication purpose. The existing schemes were effective enough but still as factors those were considering only the resources held by a node not the physical factors were present as node is to survive and communication in network. So further enhancements were possible by considering the physical parameters. Inspired from that in this paper a proposed scheme considering physical factor name as Distance is considered as the improvement to the traditional scheme. The distance factor is behaving as finding the physical presence of the node in the network also the distance factor will help to find the appropriate node for the next hop to communicate. A simulation is conducted in MATLAB software and performance factors as throughput and energy are analyzed, also an comparison with existing system is done and the results shows that the proposed scheme is effective enough to achieve QOS based routing with reduced energy consumption and high throughput.

Keywords*: *MANETs, QoS, Energy, Bandwidth, Range, Trust metrics, Reliability, Throughput.

I. INTRODUCTION

A Mobile Ad hoc Network (MANET) is a distributed system where the hubs communicate with one another without utilizing framework. The hubs in the system change their position progressively. A MANET is a self-designing; dynamic, self coordinated and framework less organize. The hubs in the system speak with one another to trade data with no brought together organization. Data is traded between the hubs utilizing different hubs in the system as middle of the road hubs. Hubs coordinate with one another to advance the information. The essential objective of MANET directing conventions is to give a right course to move the information effectively.

Mobile networks are partitioned based on fixed framework: Infrastructure systems and mobile ad hoc networks. Those systems who have wired passages known as base stations inside their transmission range are characterized as foundation versatile system. Base stations are the foundation of a framework arrange. In actuality part, versatile specially appointed systems do not bolster any sort of foundation as it is self-composed systems. As hubs in the versatile system are allowed to move in this way, it faces fast and flighty changes in the topology. [1] The fundamental disadvantage of this innovation is that hubs in the system cannot communicate straight forwardly with one another in light of the restricted transmission go. Accordingly, in the mobile ad hoc networks, routing paths have different hops and every hop in the mobile ad hoc networks can go about as a switch. Mobile ad hoc networks have a few focal points over the framework systems are simplicity of organization, improved adaptability just as decreased expenses. Mobile ad hoc networks are appropriate in threatening condition where there is no requirement for framework and in the cost significant field. [2] Some of the applications are: modern and business regions, non-military open associations, traffic the board, and instructive tasks in grounds.

The remaining sections of the paper are planned as follows. In section 2, discussions on related work are presented with description of protocols in MANETs. The parameters of quality and trust are described in Section 3. Simulation setup and results are explained in section 4. Lastly, the paper is concluded in section 5.

II. RELATED WORK

The main objective is to implement enhanced reliability approach with increased QOS factor dependency, to simulate the advanced QOLSR approach for efficient next hop selection in MANETs and to perform an analysis of proposed scheme and comparison with traditional QOLSR approach over throughput and energy.

Usha Sree et al. [3] provisioning of QoS in MANETs got researchers obsession starting late. Different QoS parameters including Link-Bandwidth and Node vitality are considered to describe a hub trust regard which shows its capacity in steering protocol. In route exposure to the goal hub, a higher trust node is picked by source hub. Also considering transmission limit and energy of hub, a way to the goal is developed by source hub. So the way breaks are minimized and the throughput is increased due to potential hubs.

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S. S. Saleh et al.[4] proposed a remote sensor framework contains a great deal of sensor devices that were commonly chipping away at battery control with a limited imperativeness resources.

The paper introduced two directing shows LEACH and EAMMH in Homogenous and Heterogeneous structures, maintaining with generation substance, using imperativeness and framework lifetime to assessment the results against known estimations.

The proposed EAMMH in both structures reduces the essential use.

N. Sirisala et al. [5] proposed a secure network by calculating node trust values in place of using encryption algorithms with same performance. The WBTQ was the extended work of OLSR protocol, where transmission was done through HELLO packets by using QoS parameters and node trust metrics. This method provided the stretchy and practical approach to find out better path by giving weightage to Trust metrics and Quality. For route establishment, WBTQ used quality and trust parameters, which was the extended version of OLSR protocol. For secure and steady route, this protocol used MPR nodes which were based on trust values or Quality parameters. The used packet designs were diagrammatically explained in the paper. Different parameters are used to calculate performance like throughput delay. The proposed method gave the better results as comparison to OLSR protocol.

V. Kalpana et al. [6] proposed an on-request QoS steering calculation for need compelled transmission capacity estimation system in MANETs. The proposed plan depends on the AOMDV convention and this plan was particularly viable, where in the circumstance of flimsy systems. Since appraisals the leftover data transmission if there was arisen an occurrence of continuous way breaks in a superior way. The proposed convention dependent on transmission capacity accessibility finds numerous courses not withstanding bounce check. The serious issue in MANETs was regular connection disappointment, and subsequently option steering methodologies did to actualize the proposed framework with decreased deferral. Generally speaking by using proposed directing conventions the connection breakages were decreased, consumed energy was less, deferrals were diminished with huge factor and it improves the system execution in a superior way.

III. PROPOSED WORK

The proposed scheme considering physical factor name as Distance is considered as the improvement to the traditional scheme. The distance factor is behaving as findingthephysical presence of the node in the network also the distance factor will help to find the appropriate node for the next hop to communicate.

If the next hop that is considered for transfering the data from sender will be selected as both of its physical factor thatis distance and also by fomulation of certainty factor as defined in equation 3.1 and 3.2

$$d = \sqrt{(X_1 - X_2)^2 + (Y_1 - Y_2)^2} \qquad (3.1)$$

Where d is distance between the node 1 and node 2 having co-ordinates as X1, Y1 and X2, Y2. if the distance d will be in the communication range R, this will help the sender node to selected neighbour node from its coverage region. Later on behalf of certainty factor the final next hop will be finalized.

Importance of the distance factor is that the node those will be shortlisted for the next hoping will be in range of the communication node and less data drop age probability will be there also the energy consumption will be less due to communication within specific range R in comparison to whole network coverage.

Once the neighbour node are selected the further process of final selection will be done on basis of below written equation

$$C_f = \frac{\left(\frac{R_E}{Th_E} + \frac{Ln_B}{Th_B}\right)}{2} \qquad (3.2)$$

Where R_E is residual energy and Th_E is threshold energy, along with this Ln_B is link bandwidth and Th_B is threshold bandwidth which it received the RREQ packet and estimates the certainty factor.

By using 3.2 eq^n. final Reliability factor is calculated, in which previous reliability of node is firstly randomly allotted for source node in between 0 to 1. Later by using below written equation final reliability of each node of source neighbour is calculated.

$$r_i = C_f * r_{i-1} \qquad (3.3)$$

Where r_{i-1} is previous node reliability from which it got RREQ and range between 0 to 1.

ENERGY MODEL: Except this for calculating the energy factor in the proposed model Energy model is used which is defined as follow:

- The energy evaluation is done by using the standard energy model and the distance is measured by using the following formulation: Following is the equation for evaluating the distance of the candidate nodes to the other nodes.

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \qquad (3.4)$$

Along with this, the energy of the nodes is evaluated by using the following formulation. E_r For energy model the transmitting energy can be evaluated by using following equation:

$$IF\ d \leq d_0\ then$$
$$\varepsilon_{TX} = (\varepsilon_{elec} * P) + (\varepsilon_{fs} * P * d^2) \qquad (3.5)$$

$$IF\ d > d_0\ then$$
$$\varepsilon_{TX} = (\varepsilon_{elec} * P) + (\varepsilon_{mp} * P * d^4) \qquad (3.6)$$

In above equations ε_{elec} stands for amount of energy consumed for transmitting data in "bit/m^2" [4].

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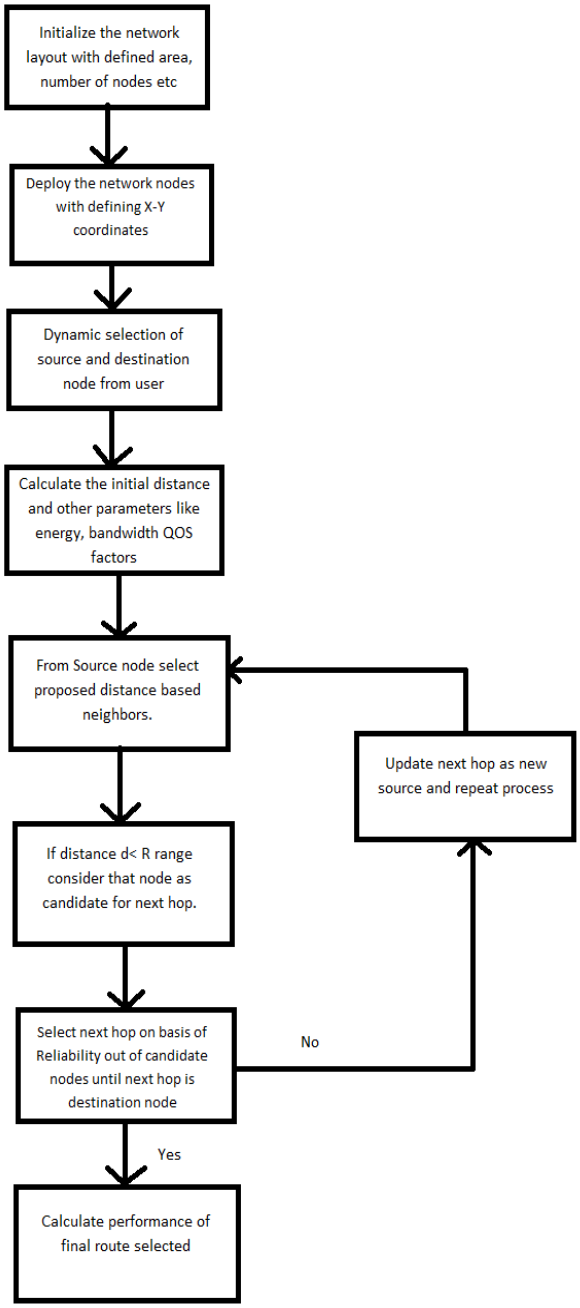

Figure 1: Flow Chart of the proposed algorithm

RANGE: In which range depends upon the Area of the network. If the area is $100m^2$ then range is 20%. The nodes are deployed randomly but if we want to connect the source and destination node then the range is considered for this criterion. The intermediate nodes are connected by calculating range of every node until it reached to the destination node. If it meets the destination node then it stops working but if destination node is not connected by the neighbor nodes then it again calculate their values and connect them. This procedure works until the shortest path is not find out, when shortest path is find out then it display the path in the network otherwise it shows the error in the network.

As given in figure 1, the framework of the proposed scheme is defined graphically; the detail description of the framework is defined in this section and written below:

After achieving results are achieved form proposed scheme the comparison is performed, which is discussed in next part.

IV. SIMULATION AND RESULTS

This section of the paper gives the detail of the results and discussion achieved from the proposed scheme simulation. The simulation of the proposed scheme is done in the matlab and details of that are given in section 4.1. Rest description of work done in the proposed scheme and the achieved results are defined below:

In table 4.1 network configuration of the proposed scheme is given in this table the factors those are defined in the forst phase of the proposed work are given the factor those are taken in the scheme are number of nodes, area, distance threshold and data packets the values of these factors are defined in the table 4.1 given below. the number of nodes are varied from 10 to 50 to achive the results in dofferent number of nodes in network and to analyze what effect does it has on the proposed scheme with varying nodes.

Table- 1: Network configuration factors

Sr No	Factors	Value
1	Number of nodes	10-50
2	Area	100x100 m^2
3	Data Packets	4000 bytes
4	Distance Threshold	33% of Area

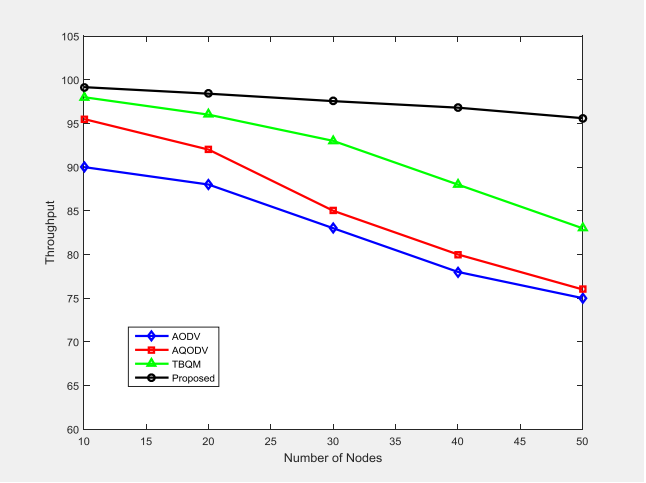

Figure 2: Comparison Graph of throughput wrt number of nodes

Table- 2: Comparison of throughput with varying nodes

Sr. No.	Nodes	AODV	AQODV	TBQM	Proposed
1	10	90	95.50	98	99.15
2	20	88	92	96	98.40
3	30	83	85	93	97.55
4	40	78	80	88	96.80
5	50	75	76	83	95.60

A comparison table 2 is given to represent the actual values those are achieved by varying the number of nodes in the network and also a comparison with other protocols is shown in the table below.

Aftre achieving the results of throughput of the proposed scheme it was mandatory to defend that proposed scheme is better with respect to traditional approach. As distance factor was introduced in the proposed scheme theimpact of the factor for the ext hop sleection in the route selection is important. this is concluded when the proposed scheme results on basis of throughput are compared with traditional schemes. For comaprison of proposed scheme the 3 other techniques are considered the techniques named as

- AODV
- AQODV
- TBQM (Trust Based QoS Model)

after comparison the results over throughput it is analyzed the the curve of throughput that is achieved in the proposed scheme is higher with respect to all other three algorithm. In figure 2 it is clearly shown that the proposed scheme is better with respect to other protocol when increased in number of nodes in the network.

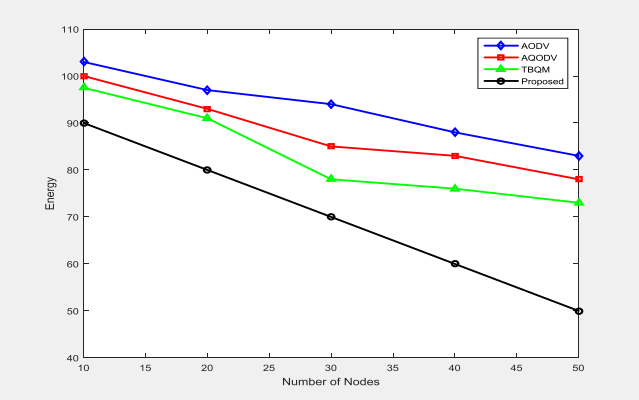

Figure 3: Comparison Graph of energy wrt number of nodes

Table-3: Comparison of energy with varying nodes

Sr. No.	Nodes	AODV	AQODV	TBQM	Proposed
1	10	103	100	97.50	89.99
2	20	97	93	91	79.99
3	30	94	85	78	69.98
4	40	88	83	76	59.97
5	50	83	78	73	49.97

Figure 3 shows the graph of proposed scheme in terms of consumed energy with varying the nodes. The proposed scheme curve is represented by black color and is lower in comaprison to other schemes AODV, AQODV and TBQM. The energy consumption of the traditional scheme are varying between approx 105 to 70 j. where as in proposed scheme has a energy consumption of 90 to 50 j only. This shows that the propsoed scheme of selection of route in the network is improved in terms of energy consumed.

V. CONCLUSION

MANETs are advanced system communicate with use of infrastructure due to which it is not an easy task to get effective communication route. In this paper a physical factor and certainty factor oriented scheme is given and evaluated. Simulation is done in the MATLAB and a performance analysis of the proposed mechanism is performed. The simulation results shows that the proposed scheme is performing effectively in term of throughput and energy consumption less energy is consumed by proposed scheme when compared to traditional schemes and also a high throughput is availed by route for network communication. The proposed scheme consumed less energy as distance factor is considered to select the candidate nodes for the next hop selection on basis of energy and bandwidth based certainty factor. Thus as a conclusion the proposed scheme is performing better and provide high QOS in the network with respect to traditional schemes.

Traditional approaches were lack of the physical factor but in proposed scheme the distance oriented scheme with certainty factor based route selection perform effectively. But still there are possibilities of improvement those can be focused in future. The proposed scheme can focus on the decision capability model for next hop selection any soft computing approach or intelligence can be applied to enhance the selection criteria and to fasten the process.

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