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Enhanced Energy Aware Geographic Routing (EEGR) Algorithm for MANET

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***Abstract:** Since the current EGR has a problem, it makes a local decision during the route discovery process to choose the next neighbour node that has the highest residual energy. This could be the worst case scenario if there is no way to stop the process and the intermediate node has lower energy than the alternate path. To solve this issue, we suggested the Enhanced Energy Aware Geographic Routing (EEGR) protocol. In EEGR, we use a modified transmission energy strategy along with numerous route requests at the destination and replies that have better node residual energy. Our simulation findings demonstrate the enhancement over the current EGR routing mechanism.*

***Keyword:** MANET, EGR, EEGR, NS2*

I. INTRODUCTION

A MANET is a self-contained, foundation-free network of mobile hosts that is permitted to move around erratically and coordinate itself in an erratically. Without the use of focal passes, all remotely enabled devices within range of one another can locate and communicate in a dispersed design. Ad hoc networks allow for frequent hub position changes. There are many uses for mobile impromptu organizations in fields such as disaster recovery, conflict zone scenarios, conference room situations, cooperative figuring, and many others; the demands placed on these types of organizations have grown steadily in a very wide range [1]. Numerous requests for various applications are necessary, and energy-efficient directing calculations are also becoming a crucial necessity. Because there is no stable basis and nodes in an impromptu organization are primarily dependent on batteries (or extensive energy hotspots) for power and the movable nature of the organization hub, satisfying this need has proven to be a challenging problem. Power accessibility is one of the key restrictions on the operation of the impromptu organization because these energy sources have a short lifespan [2].

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Fig 1: Mobile Ad Hoc Network

II. RELATED WORK

Geographic steering calculations have recently been heavily focused because to the accessibility and availability of positioning services like the global positioning system (GPS). Due to its simplicity and adaptability, geographic steering is a viable option for large-scale distant hoc businesses, and it makes advantage of the location data of hubs, which are crucial for remote organizations [4]. Geographic directing delivers a low above contrasted with other steering plans, such as proactive, responsive, and mixture geography based directing conventions because it doesn't require a course the board cycle. Geographic steering conventions function under the assumption that each hub is aware of its particular situation within the organization [5]; The real geography of the company is a good approximation of the organization network, as shown by tools like GPS or scattered restriction plans. As a result, these steering conventions presumptively assume that two hubs would have a radio network between them if they were actually close to one another, which is generally true [6]. As a result, the standards route packets from source to objective using hub area data. The capacity to communicate course demands or intermittent availability refreshes is one of the main advantages of regional steering strategies. This can save the hubs a tonne of energy and the convention above. The energy restriction is the major difference between MANETs and regular organizations. Some applications, like climate checking, require MANETs to run for a considerable amount of time. For any MANET steering convention, lengthening the lifetime of MANETs is therefore important [7]. However, the majority of geographic steering computations take the shortest neighboring route, effortlessly depleting the energy of hubs along the way. Since the geographic steering would typically convey information bundles along the full limits via edge directing on the off chance that it needs to sidestep the opening, the hubs located at the edges of openings may suffer from excessive energy consumption [8].

A system should be in place at the hub for fervent correspondence of urgent messages. This can be achieved by continuously refueling hubs, which depletes their energy and shortens the lifespan of the network. Additionally, a connection or hub failure may force a reorganization and recalculation of the guiding paths. Course selection in every correspondence design degrades network lifetime by choosing short courses, which leads in depleted batteries, or message latency by choosing long courses. As a result, the solutions for these situations should have a system to provide low dormancy [9], dependable and lax correspondence, quick reconfiguration, and minimal energy use. The great bulk of these activities involve the basic application of directing conventions. A few measurements are needed to assess the logic and application of some random convention. Any convention can be judged against its presentation based on these measurements [3]. This can save the hubs a significant amount of convention above and, hence, energy. The energy need is the primary distinction between MANETs and regular organizations. Some applications, like climate checking, require MANETs to run for a considerable amount of time. In this method, each MANET guiding convention values increasing the lifetime of MANETs [10]. Despite this, most geographic steering calculations take the shortest local route, using the hubs' energy on that route without any issues. Since the geographic steering will typically deliver information bundles along the whole boundaries by border directing assuming it needs to sidestep the opening, the hubs located on the limits of openings may suffer the negative impacts of excessive energy consumption. Due to the excessive energy use of the full limit hubs, this may widen the opening. We refer to this as a whole dispersion problem. The geographic information is widely acknowledged to be precisely accessible by several geographic guiding standards. In actuality, all local governments periodically update their geographic data. There is frequently a time difference between the update and the interest in this data, which causes errors in the geographic data and limits the precision of GPS [11]. In order to calculate the distance between two distinct hubs and evaluate energy usage, a significant amount of area data is needed. Therefore, rather than characterizing the bundle objective as a point, we should think of it as an area. We will offer the Modified Energy Aware Geographic Routing (MEGR) Protocol in this work, an unique method for calculating geographic directing that consolidates neighborhood [12] location data and modifies hub energy usage. It projects that the construction of the target hub will ensure package delivery while postponing the organization's lifespan. We also employ several models for providing energy-efficient ways.

III. METHODOLOGY

The Modified Energy Aware Geographic Routing (EEGR) protocol, which employs a different transmission power model, was explained in this section. We changed the way the current EGR finds routes. As part of the existing route request packet format, we included the minimal residual energy (MRE) field, as seen below:

- Source IP Address –
- Destination IP address –
- SSN
- DSN
- TTL
- Hop Count
- MRE

We make the choice of the route at the destination worldwide during the EEGR route discovery procedure. When the initial route request reaches the destination and the destination has had time to wait for subsequent requests, the destination will send a route reply to the route request of the path in which the node has the most remaining energy [13]. Following route selection, a node uses a different transmission power model, which is mostly based on the distance between the nodes, to send a packet to another node along the chosen path. At the source node: the source node sends the request to all of its neighbors and adds its own leftover energy to the route request's header [14]. At the intermediate node, after receiving the packet containing the route request, the header's residual energy is examined. [15] The node will transmit the request to the next neighbors and replace its own residual energy with the header's MRE if the header's residual energy is more than that of the nodes; otherwise, it will send the request directly to the next neighbors.

At the Destination: Following receipt of the route request, the destination will wait for t seconds, where t is the additional.02 milliseconds of TTL for receiving additional requests; the default value of TTL is 1 millisecond. Once reached the destination, compare the MRE values, and then respond with the maximum of all MRE.

In EEGR, a source node that has to transmit a packet to a destination obtains the destination's address. After properly preparing the packet by including pertinent information in the header, we determine the distance between each of its neighbors and the intended location [16]. We then determine the minimal amount of energy needed to deliver a packet and use that amount to send the packet.

Algorithm EEGR

In this approach, it is assumed that each node's location and remaining energy are known by a positioning system, such as a GPS system. We can determine the distance between any two nodes using the location, and we can also determine how much energy is used in our protocol. Here is the step-by-step algorithm:

Route Discovery

Begin

Step1: As they forward and send to their neighbours, source nodes contribute their own residual energy to the MRE field in the route request header.

Step2: If (Node is Destination)

Calculate Route Request MRE

$R_{E_{MRE}}$

$R_{E_{MRE}}=R_{E_{MRE}}=\sum(R_{1E_{MRE}}, \sum R_{2E_{MRE}}, ------ , \sum R_{nE_{MRE}})$

and sends route reply of route request which have maximum E_{MRE}

else

If ($E_{MRE} > E_{residual}$) // E_{MRE} is the minimum residual energy.

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// $E_{residual}$ is the node's remaining energy
Send to their neighbour after replacing the EMRE in the header with the neighbor's residue.
Without any modifications, an Else Route request is sent to their neighbour.
Step 3: Continue the process until the destination receives the request.
Step4: Once a route request has been received at the destination, that location will wait for additional route requests. / T is the amount of time the destination node waits without changing the TTL.
Step5: Direction Send a response using the path that has MaxMRE. / MaxMRE is a node with a high amount of available residual energy in the MRE route request header field.
Complete packet forwarding
Begin
We employ the following approach to obtain the packet forwarding path:

Step1: Calculate the distance using (x, y)

$$DISTANCE = \sqrt{(DISTANCE_x)^2 + (DISTANCE_y)^2}$$
// calculate distance of all neighbors node.

Step2: Using the formula below, determine the minimum transmit energy (E_{min})

$$E_{min} = \frac{E_{th} * D^n}{K}$$

Step3: Every node transmit packet with $\mathbf{E_{min}}$ of these two nodes.
End.

IV. RESULT AND DISCUSSION

In order to simulate the network topology, we are considering, we have picked 100–300 nodes and compared their topologies. Additionally, all of the nodes have random mobility.

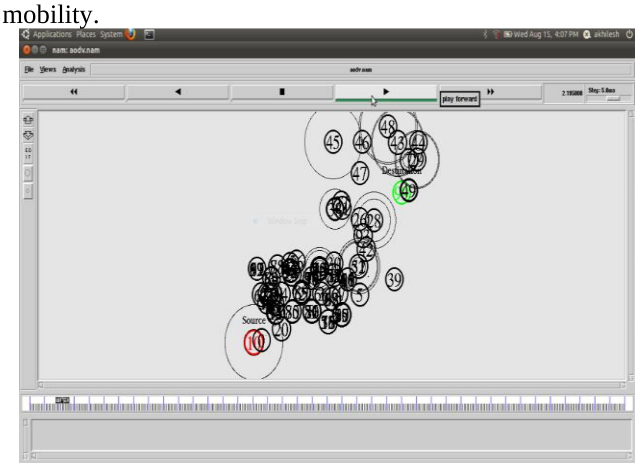

Fig 2. Network Topology

Here, as shown in the corresponding figure 2 of snapshots, the network topology of 100 nodes is shown. Node 10 is the source node that wants to communicate with node 99, and all other nodes in the network advertise node 99 as the destination by which source wants to communicate. Intermediate nodes 20, 28, 38, 49, 63, 71, 83, and 93 are used for the path and route establishment, and data communication occurs in an energy-efficient manner.

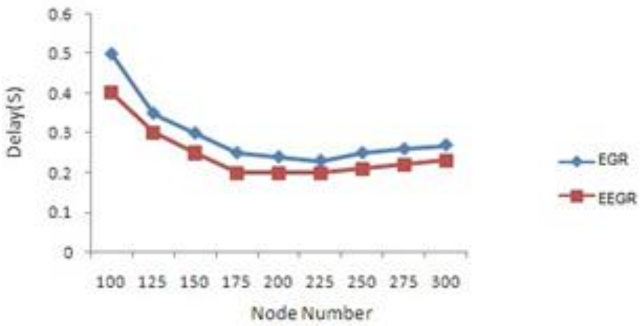

Fig 3: End to End Delay

According to the number of nodes at the x-axis and the End-End Delay at the y-axis, Figure 3 depicts the End-End Delay for the two protocols. For variable numbers of nodes, notably between 100 and 300 nodes, EEGR performs better than EGR protocol. Utilizing the EEGR's temporary routes will inevitably result in lower packet delay.

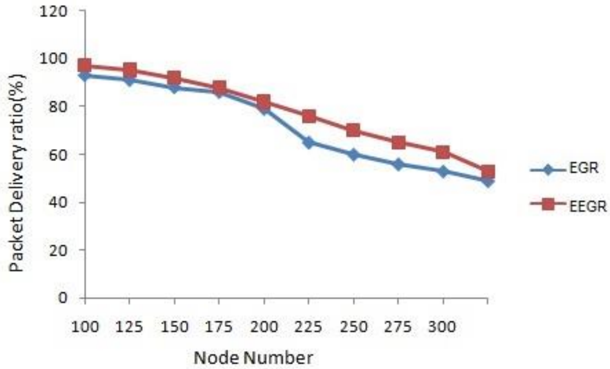

Fig 4: Packet Delivery Ratio

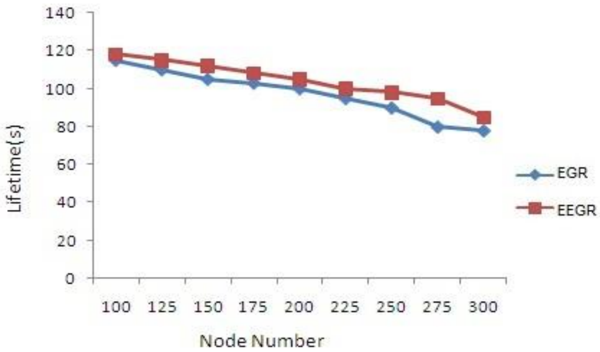

Fig 5: Network lifetime

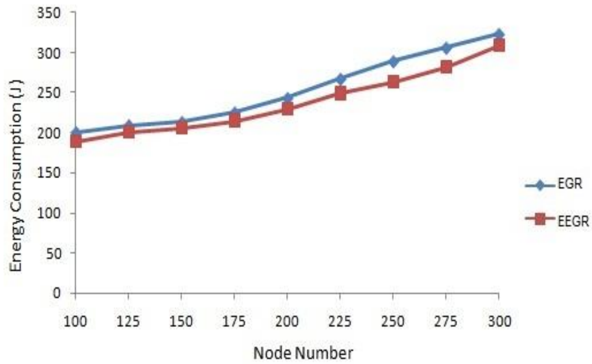

Fig. 6: Energy consumption Vs Number of Nodes

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V. CONCLUSION

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